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# UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications  
 under 37 CFR 1.53(b))

Attorney  
 Docket No.

960474B

Total Pages

First Named Inventor or Application Identifier

Takahiro SAITO et al.

Express Mail Label No.

PAGE 1 OF 3

Check Box, if applicable [ ] Duplicate

APPLICATION ELEMENTS FOR:

GROMMET WATER-PROOFING METHOD AND WIRE-  
 HARNESS LOOSENING JIG

ADDRESS TO: Director of Patents and Trademarks  
 BOX PATENT APPLICATIONS  
 Washington, D.C. 20231

1. [X] Fee Transmittal Form (Incorporated within this form)  
 (Submit an original and a duplicate for fee processing)

2. [X] Specification Total Pages [21]

3. [X] Drawing(s) (35 USC 113) Total Sheets [11]

4. [X] Oath or Declaration Total Pages [2]

a. [ ] Newly executed (original or copy)

b. [X] Copy from prior application (37 CFR 1.63(d) (for continuation/divisional with Box 17 completed).

i. [ ] Deletion of Inventor(s)

Signed statement attached deleting inventor(s) named in prior application, see 37 CFR 1.63(d)(2) and 1.33(b).

5. [X] Incorporation by reference (usable if box 4b is checked)

The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

6. [ ] Microfiche Computer Program (Appendix)

7. [ ] Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary)

a. [ ] Computer Readable Copy

b. [ ] Paper Copy (identical to computer copy)

c. [ ] Statement Verifying identity of above copies

## ACCOMPANYING APPLICATION PARTS

8. [ ] Assignment Papers (cover sheet and document(s))

9. [ ] 37 CFR 3.73(b) Statement (when there is an assignee) [ ] Power of Attorney

# UTILITY PATENT APPLICATION TRANSMITTAL

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10. ☐ English translation Document (if applicable)
11. ☒ Information Disclosure Statement ☐ Copies of IDS Citations
12. ☒ Preliminary Amendment
13. ☒ Return Receipt Postcard (MPEP 503)
14. ☐ Small Entity Statement(s) ☐ Statement filed in prior application  
Status still proper and desired.
15. ☒ Claim for Convention Priority ☐ Certified copy of Priority Document(s)
- a. Priority of Japan application no. 7-144861 filed on June 12, 1995 is claimed under 35 USC 119. The certified copy has been filed in prior application Serial No. 08/661,085. (For Continuing Applications, if applicable).
16. ☐ Other \_\_\_\_\_
17. ☒ If a CONTINUING APPLICATION, check appropriate box and supply the requisite information:
- ☐ Continuation ☒ Division ☐ Continuation-in-part (CIP) of prior application no. 09/151,353
- a. ☒ Please amend the specification by inserting after the title: --This application is a division of prior application Serial No. 09/151,353 filed September 10, 1998, which is a division of application Serial No. 08/661,085 filed June 10, 1996--.
- b. ☒ Cancel in this application original claims 1 - 6 of the prior application before calculating the filing fee.

FEE TRANSMITTAL	Number Filed	Number Extra	Rate	Basic Fee
The filing fee is calculated below				\$690.00
Total Claims	2 - 20		x \$18.00	
Independent Claims	1 - 3		x \$78.00	
Multiple Dependent Claims			\$260.00	
Basic Filing Fee				\$690.00
Reduction by 1/2 for small entity				
Fee for recording enclosed Assignment			\$40.00	
TOTAL				\$690.00

UTILITY PATENT  
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PAGE 3 OF 3

☒ A check in the amount of \$ 690.00 is enclosed to cover the filing fee.

☐ Please charge our Deposit Account No. **01-2340** in the total amount of \$ to cover the filing fee and the \$ assignment recordation fee. A duplicate of this sheet is attached.

☒ The Commissioner is hereby authorized to charge payment for any additional filing fees required under 37 CFR 1.16 or credit any overpayment to Deposit Account No. **01-2340**. A duplicate of this sheet is attached.

8. CORRESPONDENCE ADDRESS

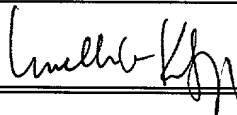
ARMSTRONG, WESTERMAN, HATTORI  
McLELAND & NAUGHTON  
1725 K Street, N.W. Suite 1000  
Washington, D.C. 20006  
Telephone: (202) 659-2930  
Facsimile: (202) 887-0357

SUBMITTED BY

Typed or Printed Name William G. Kratz, Jr.

Reg. No. 22,631

Signature



Date: July 20, 2000

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re the Application of:

**Takahiro SAITO *et al.***

Serial Number: **Division of 09/151,353**

Group Art Unit: **3729**

Filed: **July 17, 2000**

Examiner: **TUGBANG, D.**

For: **GROMMET WATER-PROOFING METHOD AND  
WIRE-HARNESS LOOSENING JIG**

**PRELIMINARY AMENDMENT**

Assistant Commissioner for Patents  
Washington, D.C. 20231

July 17, 2000

Sir:

Prior to examination, please amend the above-identified application as follows:

**IN THE DRAWINGS:**

Please remove the legend "PRIOR ART" from FIG. 15.

**IN THE SPECIFICATION:**

Please substitute the attached Substitute Specification for that on file. No new matter is involved in the Substitute Specification.

**IN THE ABSTRACT:**

Please substitute the attached Abstract for that on file.

## REMARKS

The Abstract has been rewritten and shortened and a Substitute Specification provided to clarify language, and correct typographical errors. No new matter is involved. Figure 15 is amended to remove the notation of "Prior Art" as suggested in the prior Office Action of the parent application. The Substitute Specification corresponds to that filed in parent application Serial No. 09/151,353. A marked-up copy of the original specification is also enclosed.

If, for any reason, it is felt that this application is not in condition for allowance, the Examiner is requested to contact Applicant's undersigned attorney at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed, Applicant respectfully petitions for an appropriate extension of time. The fees for such an extension or any other fees which may be due with respect to this paper, may be charged to Deposit Account No. 01-2340.

Respectfully submitted,

ARMSTRONG, WESTERMAN, HATTORI,  
MCLELAND & NAUGHTON



William G. Kratz, Jr.  
Attorney for Applicants  
Reg. No. 22,631

Atty. Docket No. 960474B  
1725 K Street, N.W., Suite 1000  
Washington, DC 20006  
Tel: (202) 659-2930  
Fax: (202) 887-0357  
WGK/nrp

Attachments: Marked-up copy of original specification

## ABSTRACT

A jig for loosening electric wires of a wire harness passed through a grommet is disclosed. The jig includes a fixing-side clamping portion for clamping the one end of a wire harness, a guide rail extending in a longitudinal direction of the wire harness, a bearing slidably engaged with the guide rail; a lock portion for locking said bearing to the guide rail, a circular rotating member, supported by said bearing, for rotating the wire harness in a circumferential direction of the wire harness; and a movable-side clamping portion, integrally attached to the rotating member, for clamping the other end of the wire harness. The rotating member may have a spiral cam groove, and the bearing may have an engagement protrusion to be engaged with the cam groove so that when the one clamping portion is inverted, the rotating member can move in its longitudinal direction. The one clamping portion may include a ratchet mechanism. Further, the one clamping portion may be shifted in a direction of compressing the wire harness by a motor.

## SUBSTITUTE SPECIFICATION

### GROMMET WATER-PROOFING METHOD AND WIRE-HARNESS LOOSENING JIG

#### BACKGROUND OF THE INVENTION

##### 1. Field of the Invention

The present invention relates to a grommet water stopping method and a wire-harness loosening jig which can loosen electric wires of a wire-harness in a grommet to surely inject a sealing agent among electric wires of the wire harness.

##### 2. Description of the Prior Art

Fig. 16 illustrates a conventional grommet water stopping method in which a wire harness 83 is passed through a small diameter portion 82 of a resilient cup-shaped grommet 81 made of synthetic resin and the cup-shaped grommet 81 is filled with a sealing agent 84 in order to prevent water from invading from the small-diameter portion 83. The sealing agent 84 is in a muddy liquid state which will be converted into a rubber state.

The above prior art, however, has a disadvantage in that water invades from gaps 85 among the electric wires constituting the wire harness 83.

In order to overcome the above disadvantage, J-UM-A-1-58222 proposes a technique in which, as shown in Fig. 17, each of electric wires has a wave curve 88 and a sealing agent 90 is caused to fill gaps 89 formed by the wave curves 88. In this technique, to form wave curves 88 for each electric wire, one by one is, very troublesome. Where the curves 88 are not located within grommet 91, gap 89 may not be formed between the electric wires and the sealing agent 90 may not fill the gaps between the electric wires.

## SUMMARY OF THE INVENTION

An object of the present invention is to provide a grommet water-proof method and an electric wire loosening jig which can inject a sealing agent between the electric wires simply and without much labor and without difference in work.

5 In accordance with one aspect of the present invention, the operation of rotating and inverting a movable-side clamping portion or the operation of shifting such clamping portion permits a wire harness to be compressed in an axial direction so that the electric wires of the wire harness can be easily loosened. For this reason, a sealing agent can be injected among the electric wires without much labor and without difference in work.

In accordance with another aspect of the present invention, when the movable-side clamping portion is inverted, such clamping portion is shifted towards a fixing-side clamping portion. Thus, the degree of loosening the wire harness can be further increased at the rotating angle equal to the above aspect of the present invention. This increases working accuracy in the operation of loosening the wire harness.

In accordance with still another aspect of the present invention, a ratchet mechanism prevents the movable-side clamping portion from being inverted at the time of twisting the wire harness, thus increasing workability.

The above and other objects and features of the present invention will be more apparent from the following description taken in conjunction with the accompanying drawings.



## BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view showing the first embodiment of a wire harness loosening jig according to the present invention;

Fig. 2 is a plan view for illustrating the operation (fixed state of a wire-harness) of a wire harness loosening jig in the first embodiment;

Fig. 3 is a plan view showing the twisted state of the wire harness in the first embodiment;

Fig. 4 is a plan view showing the state where the wire harness has been loosened in the first embodiment;

Fig. 5 is a sectional view of Fig. 4 taken along line A - A;

Fig. 6 is a perspective view of the main part of the second embodiment of the present invention;

Fig. 7 is a plan view for illustrating the operation (fixed state of a wire-harness) of the wire harness loosening jig in the second embodiment;

Fig. 8 is a plan view showing the twisted state of the wire harness in the second embodiment;

Fig. 9 is a plan view showing the state where the wire harness has been loosened simultaneously when it is inverted;

Fig. 10 is a perspective view of the third embodiment of the wire harness loosening jig according to the present invention;

Fig. 11 is a front view of the state where the clamping portion on a movable side in the third embodiment has been rotated;

Fig. 12 is a side view of the state of a ratchet exchange switch corresponding to Fig. 11;

Fig. 13 is a front view of the state where the movable-side clamping portion has been inverted;

Fig. 14 is a side view of the ratchet exchange switch corresponding to Fig. 13;

Fig. 15 is a perspective view of the fourth embodiment of the wire harness loosening jig according to the present invention;

Fig. 16 is a longitudinal sectional view of a conventional grommet waterproofing method; and

Fig. 17 is a longitudinal sectional view of another grommet waterproofing method.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

### Embodiment 1

Fig. 1 shows the first embodiment of a wire harness loosening jig (grommet water proof jig), generally designated as 1, according to the present invention.

The electric wire jig 1 includes an L-shaped base plate 2, a first or fixing side clamping portion, generally designated as 3 fixed adjacent one end of the base plate 2, a guide rail 4 extending in a direction orthogonal to the first clamping portion 3, adjacent the other end of the base plate 2, a bearing 5 slidably engaged with the guide rail 4, a circular rotating member 6 mounted on the bearing 5 and a movable-side second clamping portion 7 fixed to the rotating member 6, for rotation on rotating member 6.

The first clamping portion 3 includes a rectangular base stand 8 fixed to base plate 2, a pair of clamps 9 and 10, the first clamp 9 being fixed on the base stand 8 and the second clamp 10 being movable towards and away from the first clamp 9, and a clamper 12 for shifting the second

clamp 10 toward and away from the first clamp 9 by the operation of a lever 39. Each of the clamps 9 and 10 have an arc-shaped or V-shaped contact face 47 for clamping the wire harness 11 therebetween (see Fig. 2).

The second clamp 10 is connected to a shifting plate 14 of the clamper 12 through guide rods 13. One end of the guide rods 13 penetrate through the shifting plate 14 so that the heads 13a of the guide rods 13 abut on the shifting plate 14. Springs 15 are elastically provided between the shifting plate 14 and the clamp 10. Since the second clamp 10 is pushed by the spring 15 by the operation of the lever 39, a wire harness can be tightly sandwiched between the first clamp 9 and second clamp 10.

The clamper 12 that is commercially available includes a C-shaped link 16 connected to the stem of the lever 39, a slide bar 17 whose one end is attached to the shifting plate 14 and a bearing 18 for supporting the slide bar 17. In Fig. 1, the lever 39 is located on the movable clamp 10 side for releasing clamps 9 and 10.

On the side of the movable-side clamping portion 7, another pair of third and fourth clamps 19 and 20 are located parallel to and spaced from first and second clamps 9 and 10. The third clamp 19 is fixed to a rectangular plate 21 in parallel to the base stand 8, and as in the first side clamping portion 3, the fourth clamp 20 is connected to a clamper 24 through a guide lock 22 and springs 23. The clamper 24 is attached to the plate 21 and an operation lever 25 for the clamper 24 is located on the side for releasing the clamps.

The third clamp 19 and the plate 21 are fixed to the rotating member 6 by soldering. The rotating member 6 and the bearing 5 have recess openings 26 and 27 through which the wire harness 11 passes, respectively. The openings 26 and 27 are recessed by about 1/4 to 3/4 of their

circumference of the circle. The rotating member 6 is provided with flanges 28 and 29 at its front and rear. The flanges 28 and 29 serve as rotating guides on the bearing 5. It should be noted that the rotating center of the rotating member 6 is coincident on the clamping center of each of the clamps 9, 10, 19 and 20.

5           The rotating member 6 is rotatable over  $180^\circ$  integrally to the movable-side clamping portion 7. In order to rotate the movable-side clamping portion over  $180^\circ$ , a stopper (not shown) may be provided between the rotating member 6 and the bearing 5, or between the base plate 2 and the movable-side clamping portion 7. For example, the rotating member 6 is provided with a circumferential arc groove (not shown) and the bearing 5 is provided with a stopper shaft (not shown) and the bearing 5 is provided with a stopper shaft (not shown) engaged with the arc groove.

The bearing 5 which rotatably supports the rotating member 6 has a rectangular block shape including the recess opening 27 at its upper part, a circular through-hole 30 supporting the rotating member 6 with no clearance at its intermediate part and a sliding portion 31 slidably engaged with the guide rail 31 at its bottom part. The slide portion 31 may have a roller 32 so that it can move smoothly. The guide rail 4 is provided with a stopper 33 at its one end and extends to the base stand 8 of the fixing side clamping portion 3 at its other end.

20           The bearing 5 is provided with a lock lever 34. The bearing 5 can be locked with the guide rail 4 by operating the lock lever 34. The lock lever 34 may be provided with a cam shaft (not shown) and a pressing portion which is in contact with the cam shaft and can be pressed on the guide rail 4.

Figs. 2 and 4 illustrate the operation of the electric wire loosening jig as described above and a grommet waterproofing method.

A wire harness 11 is passed through a grommet 35 to form a grommet-equipped wire harness 36. First, the grommet equipped wire harness 36 is clamped by the fixing side clamping portion 3 at its one end and by the movable side clamping portion 7 at its other end together with a small diameter portion 35a of the grommet 35. In the state shown in Fig. 2, the lock lever 34 for the bearing 5 is in a released state.

Next, as shown in Fig. 3, the movable-side clamping portion 7 is rotated by 180° to twist the wire harness 11 (the twisted portion is denoted by reference numeral 11a). In this case, the movable-side clamping portion 7 is shifted towards the fixing side clamping portion 3 in a direction of a along the guide rail 4 by a length of the wire harness 11 shortened as a result of its twisting. The wire harness 11 is twisted between the fixed clamping portion 3 and the movable clamping portion 7.

As shown in Fig. 4, next, the lock lever 34 is rotated to lock the bearing 5. Then, the movable-side clamping portion 7 is inverted by 180° towards the restored initial position. Thus, the electric wires 37 of the wire harness 11 are loosened relative to each other between the clamping portions 3 and 7 and the wire harness, enlarged externally with gaps S formed between the wires in the grommet 35, as shown in Fig. 5.

Accordingly, a sealing agent (not shown) can permeate among the electric wires 11 in grommet 35 sufficiently to waterproof the wire harness in grommet 35. The grommet 35 is filled with the sealing agent while the grommet equipped wire harness 36 is attached to the jig 1.

## Embodiment 2

Fig. 6 shows the second embodiment of the wire harness loosening jig according to the present invention in which the rotary member 6 is further provided with another shifting mechanism in an axial direction.

5 The electric wire loosening jig 40, according to this embodiment, is provided with a cylindrical rotary member 41 that is longer than the rotating member 6 in the previous first embodiment and integral to a movable-side clamping portion 7' that is the same as in the previous embodiment. The rotating member 41 is movable in the axial direction for the bearing 5' (i.e. towards the fixing side clamping portion 3). The rotating member 41 has a cam groove 42 formed on its outer peripheral surface. The rotating member 41 and a bearing 5' have wire-harness passing-through openings 26' and 27' as in the previous embodiment, respectively.

The cam 5' is provided with a rotating lever 44 having an engagement protrusion 43 which can move on the cam groove 42. The engagement protrusion 43 is formed in a spherical shape or wedge-shape which is kept in smooth slidable contact with the cam groove 42. The rotating lever 44 has a screw portion 46 which is screwed to the side wall 45 of the bearing 5'. The tip of the screw portion 46 is communicated with the engagement protrusion 43. The rotating member 41 may have a guiding flange 28' at its one end. With the cam groove 42 engaged with the engagement protrusion 43 of the rotating lever 44, the rotating member 41 can advance towards the fixing side clamping portion 3' (in a direction of a, Fig. 6) by an inverting operation of the movable-side clamping portion 7'.

Figs. 7 to 9 illustrate the operation of the electric wire loosening jig according to this embodiment.

First, in Fig. 7, as in the previous embodiment, both ends of the grommet-equipped wire harness 36 are attached to the clamping portions 3' and 7'. In this case, the rotating lever 44 for engagement of the cam groove 42 is placed in a relaxed state so that the engagement protrusion is left from the cam groove 42.

As shown in Fig. 8, the movable side clamping portion 7' is rotated by 180° to twist the wire harness 11 so that the movable-side clamping portion 7' is once moved towards the fixing side clamping portion 3'. Thereafter, the rotating lever 44 is rotated to engage the engagement protrusion 43 with the cam groove 42. The lock lever 34' of the bearing 5' is rotated in a locking direction as shown in Fig. 9.

Next, as shown in Fig. 9, the movable-side clamping portion 7' is inverted to the original position, i.e., the rotating member 41 is rotated integrally to the movable-side clamping portion 7' so that with the cam groove 42 is in a slidable contact with the engagement protrusion 43, and the rotating member 41 is secondarily shifted together with the movable-side clamping portion 7' in a direction of arrow b. Thus, the wire harness 11 is compressed by a total distance of the first shift and the second shift so that the electric wires 37 are further loosened. In accordance with this embodiment, since the gaps among the electric wires can be further increased, the sealing agent can permeate among the electric wires more surely.

### Embodiment 3

Fig. 10 shows the third embodiment of the wire harness loosening jig according to the present invention in which the rotating member 51 is provided with a ratchet mechanism to rotate a movable-side clamping portion 7'' more surely.

As shown in Fig. 10, a grommet water-proof jig 50 is provided with an arc ratchet gear 52 along and integral to the outer peripheral surface of a circular or cylindrical rotating member 51. The ratchet gear 52 is bent in an arc shape along the rotary member 51 and has a tooth portion 52a on one side from which the rotating member 51 protrudes. The bearing 5'' which supports the rotating member 51 includes a passing-through hole 53 for the ratchet gear 52.

The bearing 5'' includes a switch 54 for ratchet switching. The rotating member 51 includes a pair of short-cylindrical pressing protrusions 55 and 56 for switch on/off. The pressing protrusions 55 and 56 are located near opposite ends of a recess opening 26'' for passing the wire harness. The switch portion 54 is connected to an engagement piece 57, spring-urged for the ratchet gear 52, which can rotate the ratchet gear 52 mechanically in only one direction or 180° rotation (Fig. 3) to prevent the inadvertent return due to the twisting repelling force of the wire harness 11. The switch portion 54 holds the state changed by the pressing protrusions 55 and 56.

Fig. 11 shows the state where the wire harness 11 has been twisted as a result of 180° rotation of the rotary member 51 in a counter-clockwise direction as shown in Fig. 10. As shown in Fig. 12, one pressing protrusion 55 presses the one end (lower part) 54a of the switching portion 54 to release the ratchet gear 52 so that the rotating member 51 can be inverted. Thus, the movable-side clamping portion 7'' integral to the rotating member 51 is inverted as shown in Fig. 13 thereby to loosen the electric wires 37 as shown in Figs. 4 and 5 directed to the first embodiment of the present invention.

In the state where the inversion has been completed as shown in Fig. 13, the other pressing protrusion 56 presses the other end (upper part) 54b of the switching portion 54 as shown in Fig. 14 so that the ratchet is operable. Specifically, as shown in Fig. 10, the piece 57 is engaged with



the ratchet gear 52. Thus, another grommet-equipped wire harness 36 can be surely twisted with no return.

#### Embodiment 4

Fig. 15 shows the fourth embodiment of the electric wire loosening jig according to the present invention.

The electric wire loosening jig 60 includes a rectangular base plate 61, a fixing-side clamping portion 62 attached to one end of the base plate 61, guide rails 63 provided in a longitudinal direction on the base plate 61, a movable-side clamping portion 64 slidably engaged with the guide rail 63 and a driving mechanism 65 for shifting the movable-side clamping portion 64 in the longitudinal direction of the wire harness 11.

The fixing-side clamping portion 62 and movable-side clamping portion 64 are provided with a pair of clamps 66 and 67, and another pair of clamps 68 and 69, respectively, and clampers 70 and 71 for shifting the clamps 67 and 69 in a radial direction of the wire harness, respectively. The movable-side clamping portion 64 has a slide portion 78 at the bottom engaged with a guide rail 63. The driving mechanism 65 includes a screw shaft 73 rotatably supported by a bearing 72 on the side of the base plate 61, a motor 74 for driving the screw shaft 73 and a manipulating lever 75 for driving the motor 74. The intermediate portion of the screw shaft 73 is screwed on the nut 77 of a base stand 64 of the movable side clamping portion 64.

In operation, after the grommet-equipped wire harness 36 is attached between both clamps 62 and 64, the operation lever 75 is put down. Then, the motor 74 starts to rotate. Eventually, the movable-side clamping portion 64 is shifted along the screw shaft 73 towards the fixing-side clamping portion 62, or in a direction (an arrow a, Fig. 15) of compressing the wire harness.

Thus, the electric wires constituting the wire harness are loosened within the grommet 35 so that gaps for permeation of a sealing agent will be formed.

Without installing the driving mechanism, the movable-side clamping portion 64 may be manually shifted in a direction of compressing the wire harness.

## ABSTRACT

A jig for loosening electric wires of a wire harness passed through a grommet is disclosed. The jig includes a fixing-side clamping portion for clamping the one end of a wire harness, a guide rail extending in a longitudinal direction of the wire harness, a bearing slidably engaged with the guide rail; a lock portion for locking said bearing to the guide rail, a circular rotating member, supported by said bearing, for rotating the wire harness in a circumferential direction of the wire harness; and a movable-side clamping portion; integrally attached to the rotating member, for clamping the other end of the wire harness. The rotating member may have a spiral cam groove, and the bearing may have an engagement protrusion to be engaged with the cam groove so that when the one clamping portion is inverted, the rotating member can move in its longitudinal direction. The one clamping portion may include a ratchet mechanism. Further, the one clamping portion may be shifted in a direction of compressing the wire harness by a motor.

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

The present invention relates to a grommet water stopping method and a wire-harness <sup>LOOSENING</sup> ~~loosing~~ jig which can <sup>LOOSEN</sup> ~~loose~~ electric wires of a wire-harness in a grommet to <sup>SURELY</sup> ~~inject~~ a sealing agent among electric wires of the wire harness ~~As before~~.

### 2. Description of the Prior Art

Fig. 16 illustrates a conventional grommet water stopping method in which a wire harness 83 is passed through a small diameter portion 82 of a resilient cup-shaped grommet 81 made of synthetic resin and the cup-shaped grommet 81 is filled with a sealing agent 84 in order to prevent water from invading from the small-diameter portion 83. The sealing agent 84 is in a muddy liquid state which will be converted into a rubber state. ~~When it is left as is.~~

The above prior art, however, has a disadvantage <sup>in</sup> that water ~~WATER~~ invades from gaps 85 among the electric wires constituting the wire harness 83.

In order to overcome the above disadvantage, J-UM-A-1-58222 proposes a technique in which, as shown in Fig. 17, each of electric wires <sup>HAS</sup> ~~is caused to have~~ a wave curve 88 and a sealing agent 90 is caused to <sup>FILL</sup> ~~fill~~ gaps 89 formed by the wave curves 88. In this technique, to form wave curves 88 for each electric

5 wire, one by one is, very troublesome. Where the  
curves 88 are not located within ~~the~~ grommet 91, ~~then~~  
<sup>NOT</sup>  
gap 89 may be formed between the electric wires and  
~~the~~ <sup>FILL</sup>  
~~the~~ sealing agent 90 may not ~~fill~~ the gaps  
<sup>BETWEEN</sup>  
~~the~~ the electric wires.

#### SUMMARY OF THE INVENTION

10 An object of the present invention is to provide  
a grommet water-proof method and an electric wire  
<sup>LOOSENING</sup>  
loosing jig which can inject a sealing agent <sup>BETWEEN THE</sup>  
~~the~~ <sup>AND</sup>  
electric wires simply <sup>WITHOUT</sup> without much labor and ~~without~~  
~~without~~ difference in work.

15 In accordance with one aspect of the present  
invention, the operation of rotating and inverting a  
movable-side clamping portion or the operation of  
shifting <sup>SUCH CLAMPING PORTION</sup> ~~the~~ permits a wire harness to be compressed  
in an axial direction so that the electric wires of  
the wire harness can be easily <sup>LOOSENED</sup> ~~loosened~~. For this  
reason, a sealing agent can be injected among the  
20 electric wires without much labor and <sup>WITHOUT</sup> ~~without~~ no  
difference in work.

25 In accordance with another aspect of the present  
invention, ~~when~~ when the movable-side clamping  
portion is inverted, <sup>SUCH CLAMPING PORTION</sup> ~~the~~ is shifted towards a fixing-  
<sup>LOOSENING</sup>  
side clamping portion. Thus, the degree of ~~loosing~~  
the wire harness can be further increased at the

rotating angle equal to the ~~angle of the~~ <sup>above</sup> aspect of the present invention. This increases working accuracy in the operation of ~~loosing~~ <sup>LOOSENING</sup> the wire harness.

5 In accordance with still another aspect of the present invention, a ratchet mechanism prevents the movable-side clamping portion from being inverted at the time of twisting the wire harness, thus increasing workability.

10 The above and other objects and features of the present invention will be more apparent from the following description taken in conjunction with the accompanying drawings.

15 BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view showing the first embodiment of a wire harness ~~loosing~~ <sup>LOOSENING</sup> jig according to the present invention;

20 Fig. 2 is a plan view for illustrating the operation (fixed state of a wire-harness) of a wire harness ~~loosing~~ <sup>LOOSENING</sup> jig in the first embodiment;

Fig. 3 is a plan view showing the twisted state of the wire harness in the first embodiment;

25 Fig. 4 is a plan view showing the state where the wire harness has been ~~loosed~~ <sup>LOOSENED</sup> in the first embodiment;

Fig. 5 is a sectional view of Fig. 4 taken along line A - A;

Fig. 6 is a perspective view of the main part of the second embodiment of the present invention;

5 Fig. 7 is a plan view for illustrating the operation (fixed state of a wire-harness) of the wire harness <sup>Loosening</sup> ~~loosing~~ jig in the second embodiment;

Fig. 8 is a plan view showing the twisted state of the wire harness in the second embodiment;

10 Fig. 9 is a plan view showing the state where the wire harness has been <sup>Loosened</sup> ~~loosed~~ simultaneously when it is inverted;

15 Fig. 10 is a perspective view of the third embodiment of the wire harness <sup>Loosening</sup> ~~loosing~~ jig according to the present invention;

Fig. 11 is a front view of the state where the clamping portion on a movable side in the third embodiment has been rotated;

20 Fig. 12 is a side view of the state of a ratchet exchange switch corresponding to Fig. 11;

Fig. 13 is a front view of the state where the movable-side clamping portion has been inverted;

Fig. 14 is a side view of the ratchet exchange switch corresponding to Fig. 13;

25 Fig. 15 is a perspective view of the fourth embodiment of the wire harness <sup>Loosening</sup> ~~loosing~~ jig according

to the present invention;

Fig. 16 is a longitudinal sectional view of a conventional grommet waterproofing method; and

Fig. 17 is a longitudinal sectional view of another grommet waterproofing method.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

### Embodiment 1

Fig. 1 shows the first embodiment of a wire harness <sup>LOOSENING</sup> ~~loosing~~ jig (grommet water proof jig), <sup>DESIGNATED AS</sup> generally 1, according to the present invention.

The electric wire jig 1 includes an L-shaped base plate 2, a <sup>FIRST OR FIXING SIDE</sup> ~~fixing side~~ clamping portion, <sup>DESIGNATED AS</sup> generally 3 fixed <sup>ADJACENT</sup> ~~adjacent~~ <sup>END</sup> ~~one end~~ of the base plate 2, a guide rail 4 extending in a direction orthogonal to the <sup>FIRST</sup> ~~fixing side~~ clamping portion 3, <sup>ADJACENT</sup> ~~adjacent~~ <sup>END</sup> ~~the other end~~ of the base plate 2, a bearing 5 slidably engaged with the guide rail 4, a circular rotating member 6 <sup>MOUNTED ON</sup> ~~mounted on~~ the bearing 5 and a movable-<sup>SECOND</sup> ~~side~~ <sup>FIXED</sup> ~~side~~ clamping portion 7 ~~adjacent to~~ <sup>FIXED</sup> ~~to~~ the rotating member 6, <sup>FOR ROTATION ON ROTATING MEMBER 6.</sup>

The <sup>FIRST</sup> ~~fixing side~~ clamping portion 3 includes a rectangular base stand 8 fixed <sup>TO</sup> ~~to~~ the base plate 2, a pair of clamps 9 and 10, <sup>BEING</sup> ~~the first clamp 9~~ fixed on the base stand 8 and the second clamp 10 <sup>BEING MOVABLE</sup> ~~movable~~ <sup>AND AWAY FROM</sup> ~~towards~~ the first clamp 9, and a



clamper 12 <sup>FOR SHIFTING</sup> ~~which can transversely shift~~ the second  
clamp 10 <sup>TOWARD AND AWAY FROM THE FIRST CLAMP 9</sup> by the operation of a lever 39. Each of the  
clamps 9 and 10 have an arc-shaped or V-shaped  
contact face 47 for <sup>CLAMPING</sup> the wire harness 11 <sup>THERRBETWEEN</sup> (see Fig. 2).

5

The second clamp 10 is connected to a shifting  
plate 14 of the clamper 12 through guide rods 13.  
One end of the guide rods 13 penetrate through the  
shifting plate 14 so that the heads 13a of the guide  
rods 13 abut on the shifting plate 14. Springs 15  
are elastically provided between the shifting plate  
14 and <sup>THE</sup> ~~the~~ clamp 10. Since the second clamp 10 is  
pushed by the spring 15 by the operation of the lever  
39, a wire harness can be tightly sandwiched between  
the first clamp 9 and second clamp 10.

The clamper 12 that is commercially available  
includes a <-shaped link 16 connected to the stem of  
the lever 39, a slide bar 17 whose one end is  
attached to the shifting plate 14 and a bearing 18  
for supporting the slide bar 17. In Fig. 1, the  
lever 39 is located on the <sup>MOVABLE CLAMP 10</sup> side <sup>FOR</sup> ~~the~~ releasing ~~the~~  
clamps <sup>9 AND 10</sup>.

On the side of the movable-side clamping portion  
7, another pair of third and fourth clamps 19 and 20  
are located <sup>PARALLEL</sup> ~~oppositely~~ to <sup>AND SPACED FROM</sup> ~~the remaining portion~~ first and  
second clamps 9 and 10. The third clamp 19 is

~~attached~~ <sup>FIXED</sup> to a rectangular plate 21 in parallel to the  
base stand 8, and as in the ~~MOVABLE~~ <sup>FIRST</sup> side clamping  
portion 3, the fourth clamp 20 is connected to a  
clammer 24 through a guide lock 22 and springs 23.  
5 The clamper 24 is attached to the plate 21 and an  
operation lever 25 for the clamper 24 is located on  
the side ~~FOR~~ <sup>FOR</sup> releasing the clamps.

10 The third clamp 19 and the plate 21 are  
~~attached~~ <sup>FIXED</sup> to the rotating member 6 by ~~soldering~~  
soldering. The rotating member 6 and the bearing 5  
have recess openings 26 and 27 through which the wire  
harness 11 pass, respectively. The openings 26 and  
27 are recessed by about 1/4 to 3/4 of their  
circumference of the circle. The rotating member 6  
15 is provided with flanges 28 and 29 at its front and  
rear. The flanges 28 and 29 serve as rotating guides  
~~ON~~ <sup>ON</sup> the bearing 5. It should be noted that the  
rotating center of the rotating member 6 is  
coincident on the clamping center of each of the  
20 clamps 9, 10, 19 and 20.

25 The rotating member 6 is rotatable over 180°  
integrally to the movable-side clamping portion 7.  
In order to rotate the movable-side clamping portion  
over 180°, a stopper (not shown) may be provided  
between the rotating member 6 and the bearing 5, or  
between the base plate 2 and the movable-side

clamping portion 7. For example, the rotating member 6 is provided with a circumferential arc groove (not shown) and the bearing 5 is provided with a stopper shaft (not shown) engaged with the arc groove.

5 The bearing 5 which rotatably supports the rotating member 6 has a rectangular block shape including the recess opening 27 at its upper part, a circular through-hole 30 supporting the rotating member 6 with no clearance at its intermediate part and a sliding portion 31 slidably engaged with the guide rail 31 at its bottom part. The slide portion 31 may have a roller 32 so that it can move smoothly. The guide rail 4 is provided with a stopper 33 at its one end and extends to the base stand 8 of the fixing side clamping portion 3 at its other end.

10 The bearing 5 is provided with a lock lever 34. The bearing 5 can be locked with the guide rail 4 by operating the lock lever 34. The lock lever 34 may be provided with a cam shaft (not shown) and a pressing portion which is in contact with the cam shaft and can be pressed on the guide rail 4.

15 Figs. 2 to 4 illustrate the operation of the electric wire <sup>LOOSENING</sup> ~~loosing~~ jig as described above and a grommet waterproof <sup>ink</sup> method.

20 ~~It is assumed that a~~ <sup>A</sup> wire harness 11 is passed through a grommet 35 to form a grommet-equipped wire

harness 36. First, the grommet equipped wire harness  
36 is clamped by the fixing side clamping portion 3  
at its one end and by the movable side clamping  
portion 7 at its other end together with a small  
5 diameter portion 35a of the grommet 35. In the state  
shown in Fig. 2, the lock lever 34 for the bearing 5  
*is in a released state.*  
~~remains lock-released.~~

Next, as shown in Fig. 3, the movable-side  
clamping portion 7 is rotated by 180° to twist the  
10 wire harness 11 (the twisted portion is denoted by  
reference numeral 11a). In this case, the movable-  
side clamping portion 7 is shifted towards the fixing  
side clamping portion 3 in a direction of a along the  
guide rail 4 by a length of the wire harness 11  
shortened as a result of its twisting. The wire  
15 harness 11 is twisted between the <sup>FIXED</sup>~~MOVABLE~~ side  
clamping portion 3 and the movable ~~MOVABLE~~ clamping  
portion 7.

*NEXT,*  
As shown in Fig. 4, <sup>1</sup>the lock lever 34 is rotated  
20 to lock the bearing 5 ~~MOVABLE~~. Then, the movable-  
side clamping portion 7 is inverted by 180° towards  
the restored initial position. Thus, the electric  
wires 37 of the wire harness 11 are <sup>LOOSENED RELATIVE TO EACH OTHER</sup>~~LOOSENED~~  
*BETWEEN THE CLAMPING PORTIONS 3 AND 7 AND THE WIRE HARNESS,*  
25 ~~MOVABLE~~ enlarged externally ~~MOVABLE~~ with gaps S FORMED  
*BETWEEN THE WIRES IN*  
~~MOVABLE~~ the grommet 35, as shown in Fig. 5.

Accordingly, a sealing agent (not shown) can permeate

among the electric wires <sup>11 in GROMMET 35</sup> sufficiently to ~~make them~~  
waterproof ~~from~~ the wire harness. <sup>IN GROMMET 35</sup> ~~INCIDENTALLY~~  
~~THE~~ ~~grommet 35~~ is filled with  
the sealing agent while the grommet equipped wire  
harness 36 is attached to the jig 1.

## Embodiment 2

Fig. 6 shows the second embodiment of the wire  
harness <sup>LOOSENING</sup> ~~loosing~~ jig according to the present  
invention in which the rotary member 6 is further  
provided with another shifting mechanism in an axial  
direction.

The electric wire <sup>LOOSENING</sup> ~~loosing~~ jig 40, according to  
this embodiment, is provided with a cylindrical rotary  
member 41 that is longer than the rotating member 6  
in the previous <sup>FIRST</sup> embodiment and integral to a movable-  
side clamping portion 7' that is the same as in the  
previous embodiment. The rotating member 41 is  
movable in the axial direction for the bearing 5'  
(i.e. towards the fixing side clamping portion 3).  
The rotating member 41 has a cam groove 42 formed on  
its outer peripheral surface. ~~It is of course that~~  
The rotating member 41 and a bearing 5' have wire-  
harness passing-through openings 26' and 27' as in  
the previous embodiment, respectively.

The cam 5' is provided with a rotating lever 44  
having an engagement protrusion 43 which can move on

the cam groove 42. The engagement protrusion 43 is formed in a spherical shape or wedge-shape which is kept in smooth slidable contact with the cam groove 42. The rotating lever 44 has a screw portion 46 which is screwed to the side wall 45 of the bearing 5'. The tip of the screw portion 46 is communicated with the engagement protrusion 43. The rotating member 41 may have a guiding flange 28' at its one end. With the cam groove 42 engaged with the engagement <sup>PROTRUSION</sup> 43 of the rotating lever 44, the rotating member 41 can advance towards the fixing side clamping portion 3' (in a direction of <sup>Fig 6</sup> ~~Fig 6~~) by an inverting operation of the movable-side clamping portion 7'.

Figs. 7 to 9 illustrate the operation of the electric wire <sup>LOOSENING</sup> ~~loosing~~ jig according to this embodiment.

First, in Fig. 7, as in the previous embodiment, both ends of the grommet-equipped wire harness 36 <sup>ARE</sup> ~~is~~ attached to the clamping portions 3' and 7'. In this case, the rotating lever 44 for engagement of the cam groove 42 is placed in a relaxed state so that the engagement protrusion is left from the cam groove 42.

As shown in Fig. 8, the movable side clamping portion 7' is rotated by 180° to twist the wire harness 11 so that the movable-side clamping portion

7' is once moved towards the fixing side clamping  
portion 3'. Thereafter, the rotating lever 44 is  
rotated to engage the engagement protrusion 43 with  
the cam groove 42. The lock lever 34' of the bearing  
5' is rotated in a locking direction as shown in Fig.  
9.

Next, as shown in Fig. 9, the movable-side  
clamping portion 7' is inverted to the original  
position, i.e., the rotating member 41 is rotated  
integrally to the movable-side clamping portion 7' so  
that with the cam groove 42 ~~there~~<sup>is</sup> in a slidable  
contact with the engagement protrusion 43, <sup>AND</sup> the  
rotating member 41 is secondarily shifted together  
with the movable-side clamping portion 7' in a  
direction of arrow b. Thus, the wire harness 11 is  
compressed by a total distance of the first shift and  
the second shift so that the electric wires 37 are  
~~loosened~~<sup>LOOSENED</sup> further ~~thereby~~. In accordance with this  
embodiment, since the gaps among the electric wires  
can be further increased, the sealing agent can  
permeate among the electric wires more surely.

### Embodiment 3

Fig. 10 shows the third embodiment of the wire  
harness ~~loosening~~<sup>LOOSENING</sup> jig according to the present  
invention in which the rotating member 51 is provided  
with a ratchet mechanism to rotate a movable-side

clamping portion 7" more surely.

As shown in Fig. 10, a grommet water-proof jig 50 is provided with an arc ratchet gear 52 along and integral to the outer peripheral surface of a circular or cylindrical rotating member 51. The ratchet gear 52 is bent in an arc shape along the rotary member 51 and has a tooth portion 52a on one side from which the rotating member 51 protrudes. The bearing 5" which supports the rotating member 51 includes a passing-through hole 53 for the ratchet gear 52.

The bearing 5" includes a switch<sup>54</sup> for ratchet switching. The rotating member 51 includes a pair of short-cylindrical pressing protrusions 55 and 56 for switch on/off. The pressing protrusions 55 and 56 are located near <sup>opposite</sup> ~~opposite~~ ends of a recess opening 26" for passing the wire harness. The switch portion 54 is connected to an engagement piece 57, spring-urged for the ratchet gear 52, which can rotate the ratchet gear 52 mechanically in only one direction or 180° rotation (Fig. 3) to prevent the inadvertent return due to the twisting repelling force of the wire harness 11. The switch portion <sup>54</sup> ~~11~~ holds the state changed by the pressing protrusions 55 and 56.

Fig. 11 shows the state where the wire harness 11 has been twisted as a result of 180° rotation of



the rotary member 51 in a counter-clockwise direction as shown in Fig. 10. As shown in Fig. 12, ~~the~~ one pressing protrusion 55 presses the one end (lower part) 54a of the switching portion 54 to release the ratchet gear 52 so that the rotating member 51 can be inverted. Thus, the movable-side clamping portion 7" integral to the rotating member 51 is inverted as shown in Fig. 13 thereby to loose<sup>the</sup> the electric wires 37 as shown in Figs. 4 and 5 directed to the first embodiment of the present invention.

In the state where the inversion has been completed as shown in Fig. 13, the other pressing protrusion 56 presses the other end (upper part) 54b of the switching portion 54 as shown in Fig. 14 so that the ratchet is operable. Specifically, as shown in Fig. 10, the piece 57 is engaged with the ratchet gear 52. Thus, another grommet-equipped wire harness 36 can be surely twisted with no return.

#### Embodiment 4

Fig. 15 shows the fourth embodiment of the electric wire <sup>Loosening</sup>~~loosing~~ jig according to the present invention.

The electric wire <sup>Loosening</sup>~~loosing~~ jig 60 includes a rectangular base plate 61, a fixing-side clamping portion 62 attached to one end of the base plate 61, ~~the~~ guide rail 63 provided in a longitudinal direction

on the base plate 61, a movable-side clamping portion 64 slidably engaged with the guide rail 63 and a driving mechanism 65 for shifting the movable-side clamping portion 64 in the longitudinal direction of the wire harness 11.

The fixing-side clamping portion 62 and movable-side clamping portion 64 are provided with a pair of clamps 66 and 67, and another pair of clamps 68 and 69, respectively, and clampers 70 and 71 for shifting the clamps 67 and 69 in a radial direction of the wire harness, respectively. The movable-side clamping portion 64 has a slide portion 78 at the bottom engaged with a guide rail 63. The driving mechanism 65 includes a screw shaft 73 rotatably supported by a bearing 72 on the side of the base plate 61, a motor 74 for driving the screw shaft 73 and <sup>A</sup>~~an~~ manipulating lever 75 for driving the motor 74. The intermediate portion of the screw shaft 73 is screwed on the nut 77 of a base stand 64 of the movable side clamping portion 64.

In operation, after the grommet-equipped wire harness 36 is attached between both clamps 62 and 64, the operation lever 75 is put down. Then, the motor 74 starts to rotate. Eventually, the movable-side clamping portion 64 is shifted along the screw shaft 73 towards the fixing-side clamping portion 62, or in

<sup>Q, FIG. 15</sup>  
a direction (an arrow ~~41~~) of compressing the wire  
harness. Thus, the electric wires constituting the  
wire harness are <sup>LOOSEMED</sup> ~~loosed~~ within the grommet 35 so that  
gaps for permeation of a sealing agent will be  
formed.

Without installing the driving mechanism, the  
movable-side clamping portion 64 may be manually  
shifted in a direction of compressing the wire  
harness.

Title of the Invention

GROMMET WATER-PROOFING METHOD AND WIRE-HARNESS

LOOSING JIG

000000-000000

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

5 The present invention relates to a grommet water stopping method and a wire-harness loosing jig which can loose electric wires of a wire-harness in a grommet to inject a sealing agent among electric wires of the wire harness surely.

### 2. Description of the Prior Art

10 Fig. 16 illustrates a conventional grommet water stopping method in which a wire harness 83 is passed through a small diameter portion 82 of a resilient cup-shaped grommet 81 made of synthetic resin and the cup-shaped grommet 81 is filled with a sealing agent 84 in order to prevent water from invading from the small-diameter portion 83. The sealing agent 84 is in a muddy liquid state which will be converted into a rubber state when it is left as it is.

15 The above prior art, however, has a disadvantage that water will invades from gaps 85 among the electric wires constituting the wire harness 83.

20 In order to overcome the above disadvantage, J-UM-A-1-58222 proposes a technique in which as shown in Fig. 17, each of electric wires is caused to have a wave curve 88 and a sealing agent 90 is caused to invade gaps 89 formed by the wave curves 88. In this technique, to form wave curves 88 for each electric

wire one by one is very troublesome. Where the  
curves 88 are not located within a grommet 91, no  
gap 89 may be formed between the electric wires and  
so that the sealing agent 90 may not invade the gaps  
among the electric wires.

#### SUMMARY OF THE INVENTION

An object of the present invention is to provide  
a grommet water-proof method and an electric wire  
loosing jig which can inject a sealing agent in among  
electric wires simply without much labor and surely  
with no difference in work.

In accordance with one aspect of the present  
invention, the operation of rotating and inverting a  
movable-side clamping portion or the operation of  
shifting it permits a wire harness to be compressed  
in an axial direction so that the electric wires of  
the wire harness can be easily loosed. For this  
reason, a sealing agent can be injected among the  
electric wires without much labor and surely with no  
difference in work.

In accordance with another aspect of the present  
invention, also when the movable-side clamping  
portion is inverted, it is shifted towards a fixing-  
side clamping portion. Thus, the degree of loosening  
the wire harness can be further increased at the

rotating angle equal to the case of the above aspect of the present invention. This increases working accuracy in the operation of loosening the wire harness.

5 In accordance with still another aspect of the present invention, a ratchet mechanism prevents the movable-side clamping portion from being inverted at the time of twisting the wire harness, thus increasing workability.

The above and other objects and features of the present invention will be more apparent from the following description taken in conjunction with the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view showing the first embodiment of a wire harness loosening jig according to the present invention;

20 Fig. 2 is a plan view for illustrating the operation (fixed state of a wire-harness) of a wire harness loosening jig in the first embodiment;

Fig. 3 is a plan view showing the twisted state of the wire harness in the first embodiment;

25 Fig. 4 is a plan view showing the state where the wire harness has been loosened in the first embodiment;

Fig. 5 is a sectional view of Fig. 4 taken along line A - A;

Fig. 6 is a perspective view of the main part of the second embodiment of the present invention;

5 Fig. 7 is a plan view for illustrating the operation (fixed state of a wire-harness) of the wire harness loosing jig in the second embodiment;

Fig. 8 is a plan view showing the twisted state of the wire harness in the second embodiment;

10 Fig. 9 is a plan view showing the state where the wire harness has been loosed simultaneously when it is inverted;

15 Fig. 10 is a perspective view of the third embodiment of the wire harness loosing jig according to the present invention;

Fig. 11 is a front view of the state where the clamping portion on a movable side in the third embodiment has been rotated;

20 Fig. 12 is a side view of the state of a ratchet exchange switch corresponding to Fig. 11;

Fig. 13 is a front view of the state where the movable-side clamping portion has been inverted;

Fig. 14 is a side view of the ratchet exchange switch corresponding to Fig. 13;

25 Fig. 15 is a perspective view of the fourth embodiment of the wire harness loosing jig according



to the present invention;

Fig. 16 is a longitudinal sectional view of a conventional grommet waterproofing method; and

Fig. 17 is a longitudinal sectional view of another grommet waterproofing method.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

##### Embodiment 1

Fig. 1 shows the first embodiment of a wire harness loosing jig (grommet water proof jig), generally 1, according to the present invention.

The electric wire jig 1 includes an L-shaped base plate 2, a fixing-side clamping portion, generally 3 fixed on the one side of the base plate 2, a guide rail 4 extending in a direction orthogonal to the fixing-side clamping portion 3 on the other side of the base plate 2, a bearing 5 slidably engaged with the guide rail 4, a circular rotating member 6 engaged with the bearing 5 and a movable-side clamping portion 7 integrally to the rotating member 6.

The fixing-side clamping portion 3 includes a rectangular base stand 8 fixed on the base plate 2, a pair of clamps 9 and 10 (the first clamp 9 fixed on the base stand 8 and the second clamp 10 which can move from and towards the first clamp 9), and a

clamper 12 which can transversely shift the second clamp 10 by the operation of a lever 39. Each of the clamps 9 and 10 have an arc-shaped or V-shaped contact face 47 for the wire harness 11 (see Fig. 2).

5

The second clamp 10 is connected to a shifting plate 14 of the clamper 12 through guide rods 13. One ends of the guide rods 13 penetrate through the shifting plate 14 so that the heads 13a of the guide rods 13 abut on the shifting plate 14. Springs 15 are elastically provided between the shifting plate 14 and teh clamp 10. Since the second clamp 10 is pushed by the spring 15 by the operation of the lever 39, a wire harness can be tightly sandwiched between the first clamp 9 and second clamp 10.

The clamper 12 that is commercially available includes a { -shaped link 16 connected to the stem of the lever 39, a slide bar 17 whose one end is attached to the shifting plate 14 and a bearing 18 for supporting the slide bar 17. In Fig. 1, the lever 39 is located on the side of releasing the clamps.

On the side of the movable-side clamping portion 7, another pair of third and fourth clamps 19 and 20 are located oppositely to the above pair of first and second clamps 9 and 10. The third clamp 19 is

attached to a rectangular plate 21 in parallel to the base stand 8, and as in the fixing-side clamping portion 3, the fourth clamp 20 is connected to a clamper 24 through a guide lock 22 and springs 23.

5 The clamper 24 is attached to the plate 21 and an operation lever 25 for the clamper 24 is located on the side of releasing the clamps.

10 The third clamp 19 and the plate 21 are integrated to the rotating member 6 by means of soldering. The rotating member 6 and the bearing 5 have recess openings 26 and 27 through which the wire harness 11 pass, respectively. The openings 26 and 27 are recessed by about  $1/4$  to  $3/4$  of their circumference of the circle. The rotating member 6 is provided with flanges 28 and 29 at its front and rear. The flanges 28 and 29 serve as rotating guides for the bearing 5. It should be noted that the rotating center of the rotating member 6 is coincident on the clamping center of each of the clamps 9, 10, 19 and 20.

20 The rotating member 6 is rotatable over  $180^\circ$  integrally to the movable-side clamping portion 7. In order to rotate the movable-side clamping portion over  $180^\circ$ , a stopper (not shown) may be provided between the rotating member 6 and the bearing 5, or 25 between the base plate 2 and the movable-side

clamping portion 7. For example, the rotating member 6 is provided with a circumferential arc groove (not shown) and the bearing 5 is provided with a stopper shaft (not shown) engaged with the arc groove.

5           The bearing 5 which rotatably supports the rotating member 6 has a rectangular block shape including the recess opening 27 at its upper part, a circular through-hole 30 supporting the rotating member 6 with no clearance at its intermediate part and a sliding portion 31 slidably engaged with the guide rail 4 at its bottom part. The slide portion 31 may have a roller 32 so that it can move smoothly. The guide rail 4 is provided with a stopper 33 at its one end and extends to the base stand 8 of the fixing side clamping portion 3 at its other end.

10           The bearing 5 is provided with a lock lever 34. The bearing 5 can be locked with the guide rail 4 by operating the lock lever 34. The lock lever 34 may be provided with a cam shaft (not shown) and a pressing portion which is in contact with the cam shaft and can be pressed on the guide rail 4.

15           Figs. 2 to 4 illustrate the operation of the electric wire loosening jig as described above and a grommet waterproof method.

20           It is assumed that a wire harness 11 is passed through a grommet 35 to form a grommet-equipped wire

harness 36. First, the grommet equipped wire harness 36 is clamped by the fixing side clamping portion 3 at its one end and by the movable side clamping portion 7 at its other end together with a small diameter portion 35a of the grommet 35. In the state shown in Fig. 2, the lock lever 34 for the bearing 5 remains lock-released.

Next, as shown in Fig. 3, the movable-side clamping portion 7 is rotated by 180° to twist the wire harness 11 (the twisted portion is denoted by reference numeral 11a). In this case, the movable-side clamping portion 7 is shifted towards the fixing side clamping portion 3 in a direction of a along the guide rail 4 by a length of the wire harness 11 shortened as a result of its twisting. The wire harness 11 is twisted between the fixing side clamping portion 3 and the movable-side clamping portion 7.

As shown in Fig. 4, the lock lever 34 is rotated to lock the bearing 5 unmovably. Then, the movable-side clamping portion 7 is inverted by 180° towards the restored initial position. Thus, the electric wires 37 of the wire harness 11 are loosed so that they are enlarged externally and located with gaps S within the grommet 35 as shown in Fig. 5. Accordingly, a sealing agent (not shown) can permeate

among the electric wires sufficiently to make sure waterproof for the wire harness. Incidentally, it should be noted that the grommet 35 is filled with the sealing agent while the grommet equipped wire harness 36 is attached to the jig 1.

#### Embodiment 2

Fig. 6 shows the second embodiment of the wire harness loosing jig according to the present invention in which the rotary member 6 is further provided with another shifting mechanism in an axial direction.

The electric wire loosing jig 40 according to this embodiment is provided with a cylindrical rotary member 41 that is longer than the rotating member 6 in the previous embodiment and integral to a movable-side clamping portion 7' that is the same as in the previous embodiment. The rotating member 41 is movable in the axial direction for the bearing 5' (i.e. towards the fixing side clamping portion 3).

The rotating member 41 has a cam groove 42 formed on its outer peripheral surface. It is of course that the rotating member 41 and a bearing 5' have wire-harness passing-through openings 26' and 27' as in the previous embodiment, respectively.

The cam 5' is provided with a rotating lever 44 having an engagement protrusion 43 which can move on

the cam groove 42. The engagement protrusion 43 is formed in a spherical shape or wedge-shape which is kept in smooth slidable contact with the cam groove 42. The rotating lever 44 has a screw portion 46 which is screwed to the side wall 45 of the bearing 5'. The tip of the screw portion 46 is communicated with the engagement protrusion 43. The rotating member 41 may have a guiding flange 28' at its one end. With the cam groove 42 engaged with the engagement 43 of the rotating lever 44, the rotating member 41 can advance towards the fixing side clamping portion 3' (in a direction of b) by an inverting operation of the movable-side clamping portion 7'.

Figs. 7 to 9 illustrate the operation of the electric wire loosening jig according to this embodiment.

First, in Fig. 7, as in the previous embodiment, both ends of the grommet-equipped wire harness 36 is attached to the clamping portions 3' and 7'. In this case, the rotating lever 44 for engagement of the cam groove 42 is placed in a relaxed state so that the engagement protrusion is left from the cam groove 42.

As shown in Fig. 8, the movable side clamping portion 7' is rotated by 180° to twist the wire harness 11 so that the movable-side clamping portion

7' is once moved towards the fixing side clamping portion 3'. Thereafter, the rotating lever 44 is rotated to engage the engagement protrusion 43 with the cam groove 42. The lock lever 34' of the bearing 5' is rotated in a locking direction as shown in Fig. 9.

Next, as shown in Fig. 9, the movable-side clamping portion 7' is inverted to the original position, i.e., the rotating member 41 is rotated integrally to the movable-side clamping portion 7' so that with the cam groove 42 being in a slidable contact with the engagement protrusion 43, the rotating member 41 is secondarily shifted together with the movable-side clamping portion 7' in a direction of arrow b. Thus, the wire harness 11 is compressed by a total distance of the first shift and the second shift so that the electric wires 37 are loosed further greatly. In accordance with this embodiment, since the gaps among the electric wires can be further increased, the sealing agent can permeate among the electric wires more surely.

### Embodiment 3

Fig. 10 shows the third embodiment of the wire harness loosing jig according to the present invention in which the rotating member 51 is provided with a ratchet mechanism to rotate a movable-side



clamping portion 7" more surely.

As shown in Fig. 10, a grommet water-proof jig 50 is provided with an arc ratchet gear 52 along and integral to the outer peripheral surface of a circular or cylindrical rotating member 51. The ratchet gear 52 is bent in an arc shape along the rotary member 51 and has a tooth portion 52a on one side from which the rotating member 51 protrudes. The bearing 5" which supports the rotating member 51 includes a passing-through hole 53 for the ratchet gear 52.

The bearing 5" includes a switch for ratchet switching. The rotating member 51 includes a pair of short-cylindrical pressing protrusions 55 and 56 for switch on/off. The pressing protrusions 55 and 56 are located near both ends of a recess opening 26" for passing the wire harness. The switch portion 54 is connected to an engagement piece 57 spring-urged for the ratchet gear 52, which can rotate the ratchet gear 52 mechanically in only one direction or 180° rotation (Fig. 3) to prevent the inadvertent return due to the twisting repelling force of the wire harness 11. The switch portion 5 holds the state changed by the pressing protrusions 55 and 56.

Fig. 11 shows the state where the wire harness 11 has been twisted as a result of 180° rotation of

the rotary member 51 in a counter-clockwise direction as shown in Fig. 10. As shown in Fig. 12, the one pressing protrusion 55 presses the one end (lower part) 54a of the switching portion 54 to release the ratchet gear 52 so that the rotating member 51 can be inverted. Thus, the movable-side clamping portion 7" integral to the rotating member 51 is inverted as shown in Fig. 13 thereby to loose the electric wires 37 as shown in Figs. 4 and 5 directed to the first embodiment of the present invention.

In the state where the inversion has been completed as shown in Fig. 13, the other pressing protrusion 56 presses the other end (upper part) 54b of the switching portion 54 as shown in Fig. 14 so that the ratchet is operable. Specifically, as shown in Fig. 10, the piece 57 is engaged with the ratchet gear 52. Thus, another grommet-equipped wire harness 36 can be surely twisted with no return.

#### Embodiment 4

Fig. 15 shows the fourth embodiment of the electric wire loosening jig according to the present invention.

The electric wire loosening jig 60 includes a rectangular base plate 61, a fixing-side clamping portion 62 attached to one end of the base plate 61, a guide rail 63 provided in a longitudinal direction

on the base plate 61, a movable-side clamping portion 64 slidably engaged with the guide rail 63 and a driving mechanism 65 for shifting the movable-side clamping portion 64 in the longitudinal direction of the wire harness 11.

The fixing-side clamping portion 62 and movable-side clamping portion 64 are provided with a pair of clamps 66 and 67, and another pair of clamps 68 and 69, respectively, and clampers 70 and 71 for shifting the clamps 67 and 69 in a radial direction of the wire harness, respectively. The movable-side clamping portion 64 has a slide portion 78 at the bottom engaged with a guide rail 63. The driving mechanism 65 includes a screw shaft 73 rotatably supported by a bearing 72 on the side of the base plate 61, a motor 74 for driving the screw shaft 73 and an manipulating lever 75 for driving the motor 74. The intermediate portion of the screw shaft 73 is screwed on the nut 77 of a base stand 64 of the movable side clamping portion 64.

In operation, after the grommet-equipped wire harness 36 is attached between both clamps 62 and 64, the operation lever 75 is put down. Then, the motor 74 starts to rotate. Eventually, the movable-side clamping portion 64 is shifted along the screw shaft 73 towards the fixing-side clamping portion 62, or in

a direction (an arrow b ) of compressing the wire harness. Thus, the electric wires constituting the wire harness are loosed within the grommet 35 so that gaps for permeation of a sealing agent will be formed.

Without installing the driving mechanism, the movable-side clamping portion 64 may be manually shifted in a direction of compressing the wire harness.

What is claimed is:

1. A grommet water-proofing method in which a grommet through which a wire harness is passed is filled with a sealing agent, comprising the steps:

5 clamping a wire harness between a first and a second clamping portion at the front and rear of the grommet;

rotating a first clamping portion to twist said wire harness in a first direction;

10 with said first clamping portion being immovable in a longitudinal direction of the wire harness, inverting said first clamping portion in a second direction opposite to said first direction so that the wire harness is loosed within said grommet; and

15 filling the grommet with a sealing agent.

2. A grommet water-proofing method in which a grommet through which a wire harness is passed is filled with a sealing agent, comprising the steps:

20 clamping a wire harness between a first and a second clamping portion at the front and rear of the grommet;

25 shifting said first clamping portion in a direction of compressing the wire harness so that the wire harness is loosed within said grommet; and

filling the grommet with a sealing agent.

3. An wire-harness loosing jig comprising:

a fixing side clamping portion for clamping one end of a wire harness;

a guide rail extending in a longitudinal direction of said wire harness; -

a bearing slidably engaged with said guide rail;

a lock portion for locking said bearing to said guide rail;

a circular rotating member, supported by said bearing, for rotating said wire harness in a peripheral direction of said wire harness; and

a movable-side clamping portion, integrally attached to said rotating member, for clamping the other end of said wire harness.

4. A wire harness loosing jig according to claim 3, wherein said rotating member has a spiral cam groove; and said bearing has an engagement protrusion to be engaged with the cam groove so that when the one clamping portion is inverted, the rotating member can move in the longitudinal direction of the wire harness.

5. A wire harness loosing jig according to claim 3, wherein said rotating member includes a ratchet gear and a pressing protrusion; and said bearing includes

a switch portion for engaging an engagement piece with said ratchet gear, said switching portion being changeable by said pressing protrusion so that said ratchet can operate in a direction of twisting said wire harness.

6. A wire harness loosening jig according to claim 4, wherein said rotating member includes a ratchet gear and a pressing protrusion; and said bearing includes a switch portion for engaging an engagement piece with said ratchet gear, said switching portion being changeable by said pressing protrusion so that said ratchet gear can operate in a direction of twisting said wire harness.

7. A wire harness loosening jig comprising:  
a fixing-side clamping portion for clamping one end of a wire harness;  
a guide rail extending in a longitudinal direction of said wire harness; and  
a movable-side clamping portion for clamping the other end of said wire harness.

8. A wire harness loosening jig according to claim 7, wherein said movable-side can be moved towards the fixing-side clamping portion by a driving mechanism.

ABSTRACT OF THE DISCLOSURE

A method and jig for loosening electric wires of a wire harness passed through a grommet are disclosed. A wire harness is clamped at the front and rear of a grommet. One clamping portion of the jig is rotated to twist the wire harness and thereafter inverted to loose it. Otherwise, the one clamping portion is moved in a direction of compressing the wire harness. The jig includes a fixing-side clamping portion for clamping the one end of a wire harness, a guide rail extending in a longitudinal direction of the wire harness, a bearing slidably engaged with the guide rail; a lock portion for locking said bearing to the guide rail, a circular rotating member, supported by said bearing, for rotating the wire harness in a circumferential direction of the wire harness; and a movable-side clamping portion, integrally attached to the rotating member, for clamping the other end of said wire harness. The rotating member may have a spiral cam groove, and the bearing may have an engagement protrusion to be engaged with the cam groove so that when the one clamping portion is inverted, the rotating member can move in its longitudinal direction. The one clamping portion may include a ratchet mechanism. Further, the one clamping portion may be shifted in a direction of



compressing the wire harness by a motor. Thus, a  
sealing agent can be surely injected among the  
electric wires of the wire harness.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of: Takahiro SAITO et al.

Prior Art Unit: 3729

Serial Number: (Division of S.N. 09/151,353)

Prior Examiner: TUGBANG, D.

Filed: 09/151,353

For: GROMMET WATER-PROOFING METHOD AND WIRE-HARNESS  
LOOSENING JIG

REQUEST FOR APPROVAL OF DRAWING CHANGES

Director of Patents and Trademarks  
Washington, D.C. 20231

July 20, 2000

Sir:

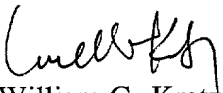
The Examiner's approval of the drawing correction indicated in red ink on the attached sheet of drawings is respectfully requested.

Upon receipt of approval of the drawing correction and a formal Notice of Allowance, a bonded draftsman will be retained and the appropriate correction will be made.

In the event any fees are required in connection with this paper, please charge our Deposit Account No. 01-2340.

Respectfully submitted,

ARMSTRONG, WESTERMAN, HATTORI,  
McLELAND & NAUGHTON

  
William G. Kratz, Jr.  
Attorney for Applicants  
Reg. No. 22,631

Atty. Docket No. **960474B**

1725 K Street, N.W., Suite 1000

Washington, DC 20006

Tel: (202) 659-2930

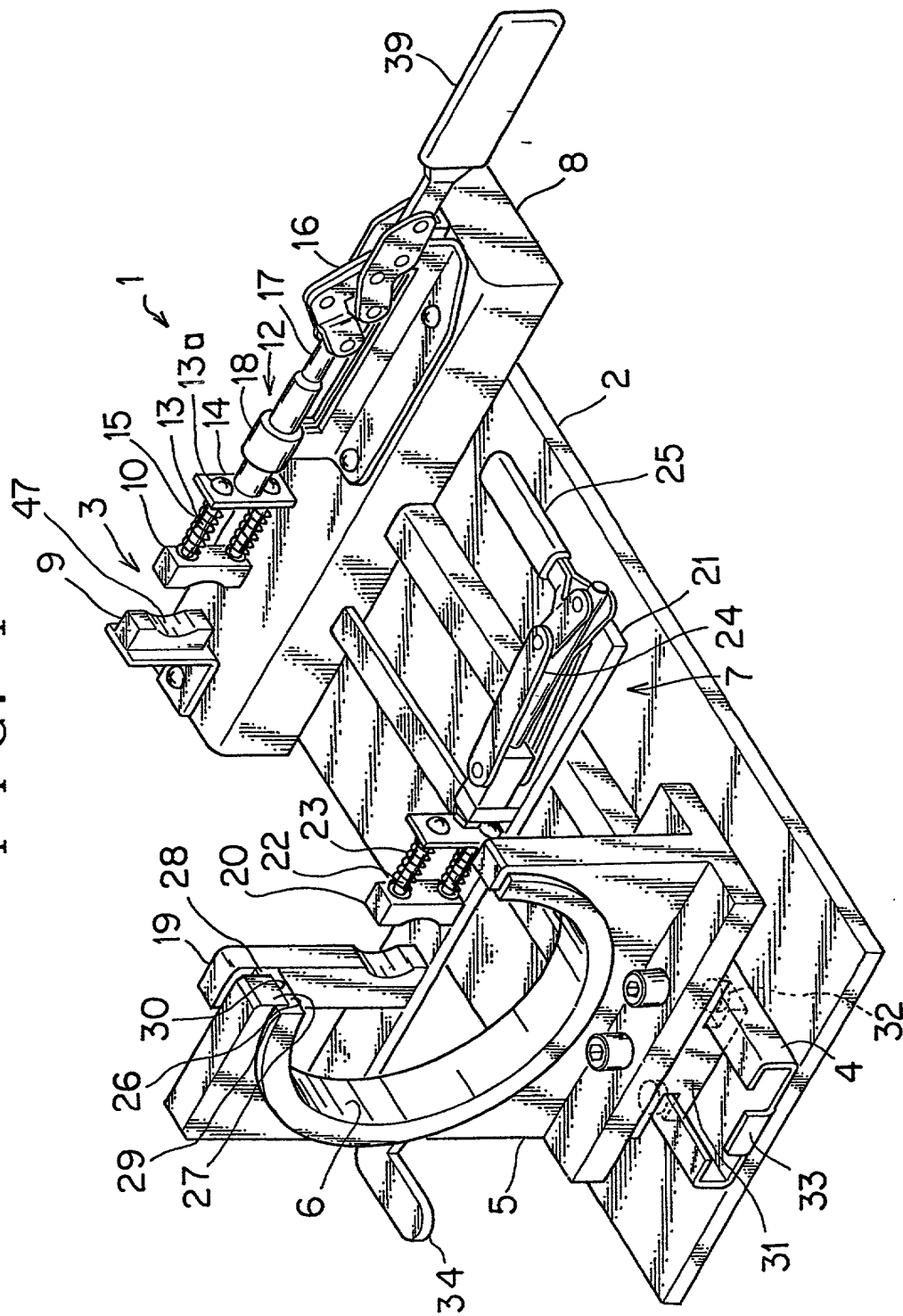
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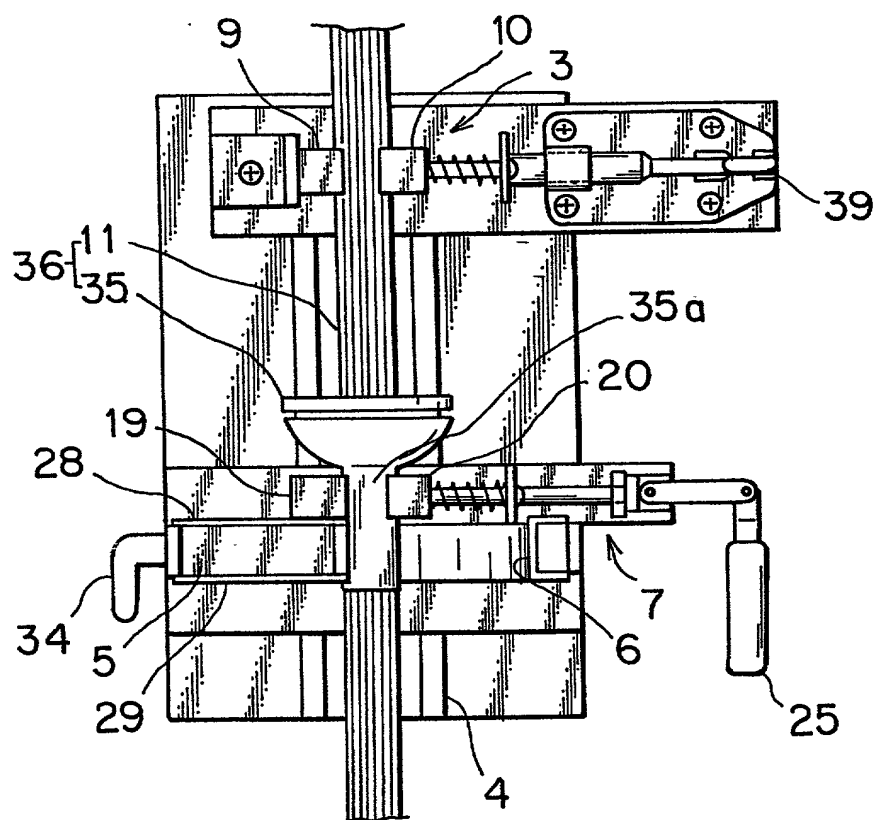
Attachment: One Sheet of Corrected Drawing



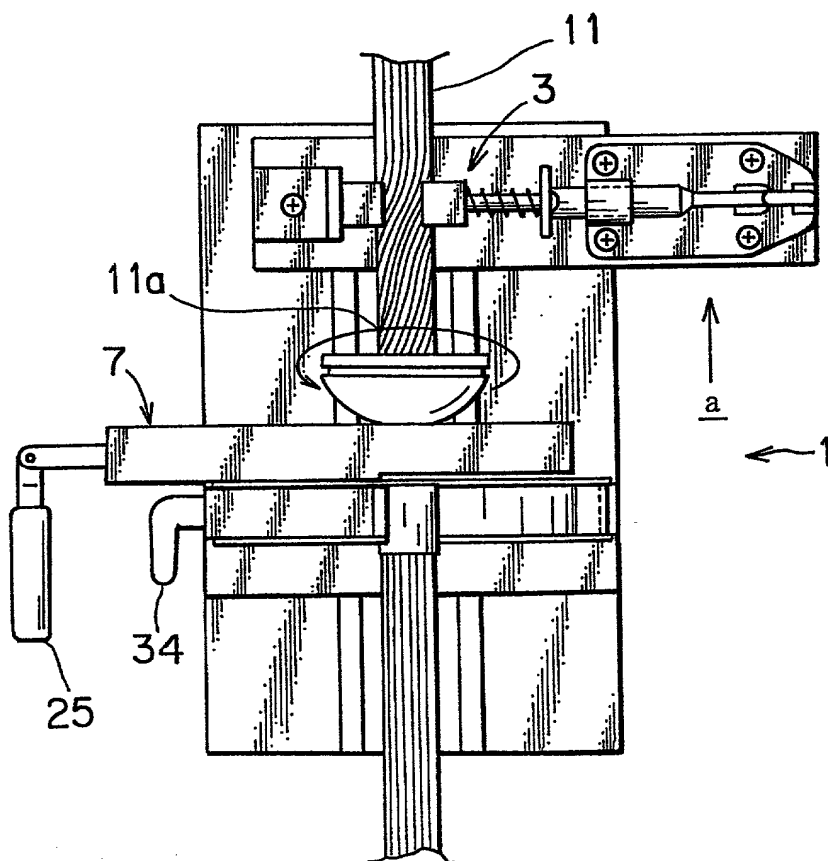
FIG. 1



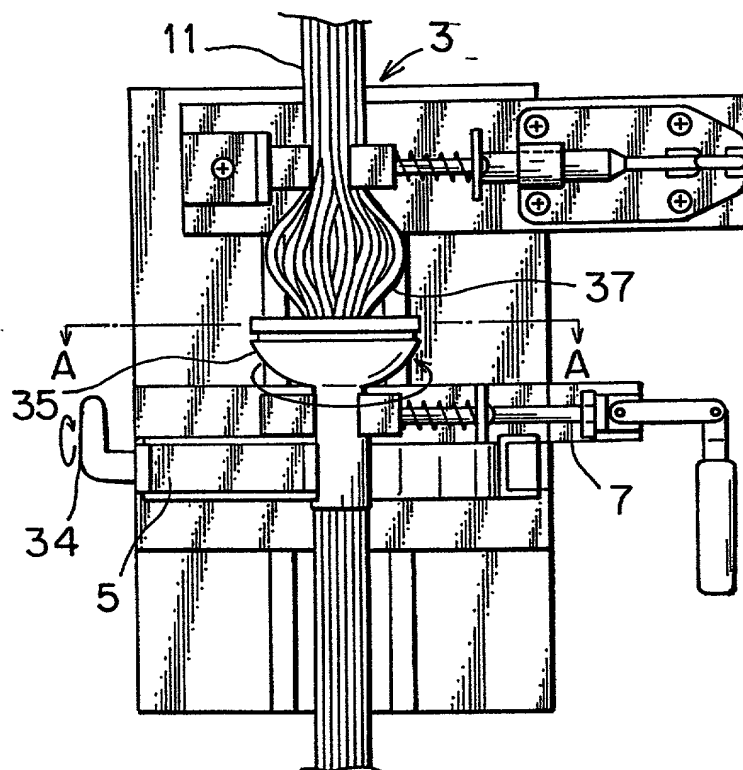
F I G. 2



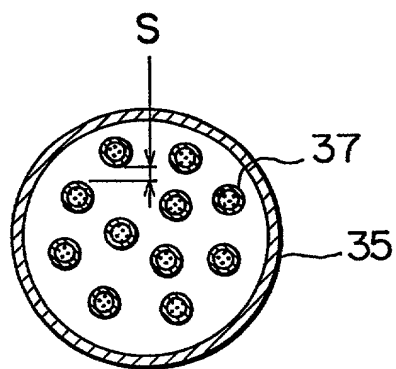
F I G. 3



F I G. 4



F I G. 5



F I G. 6

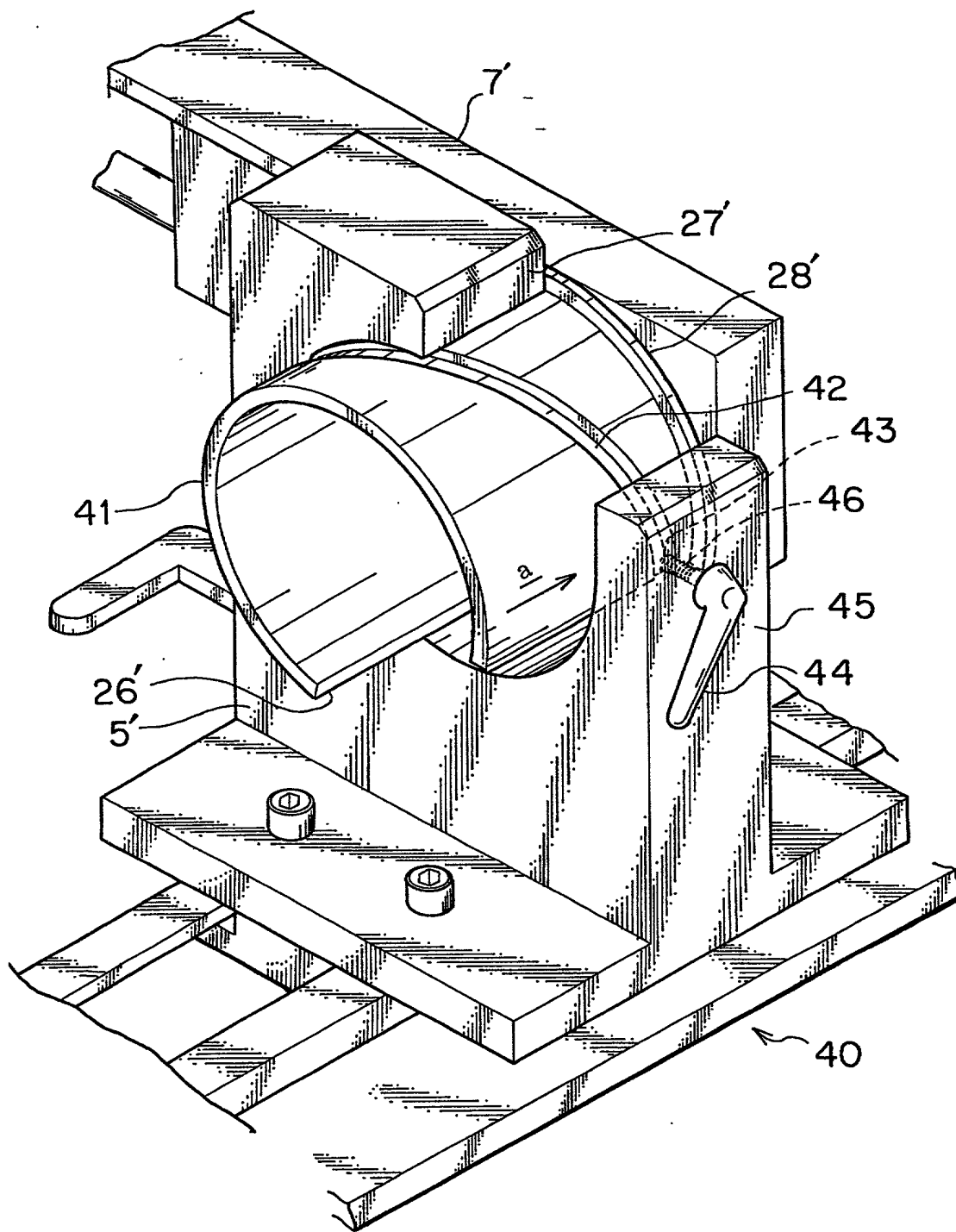


FIG. 7

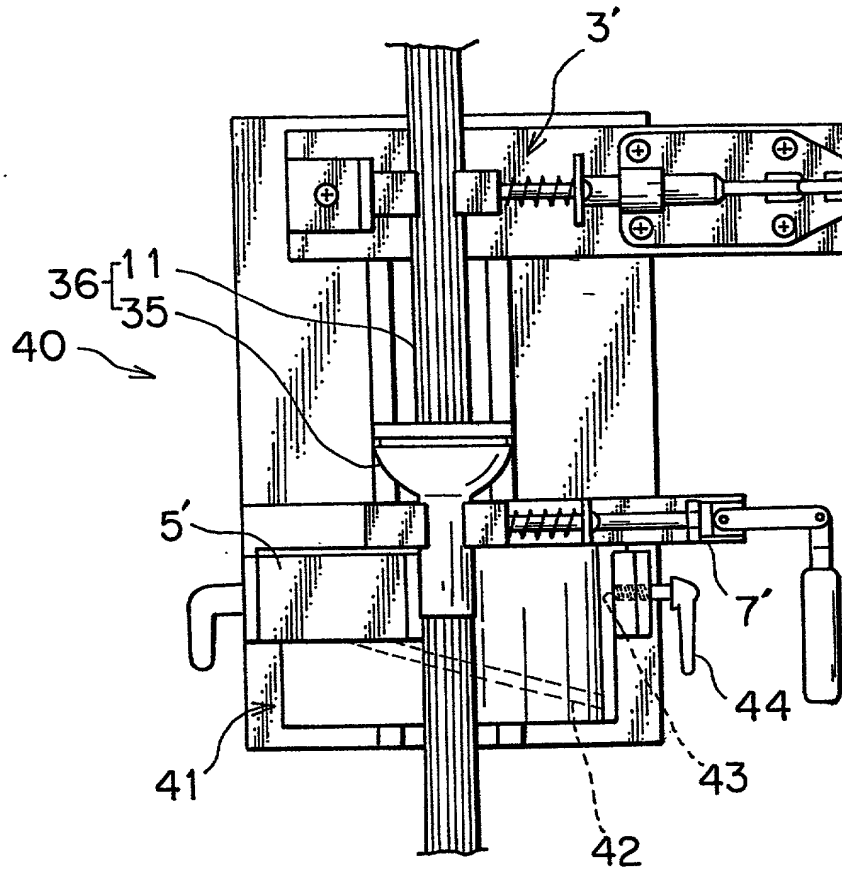


FIG. 8

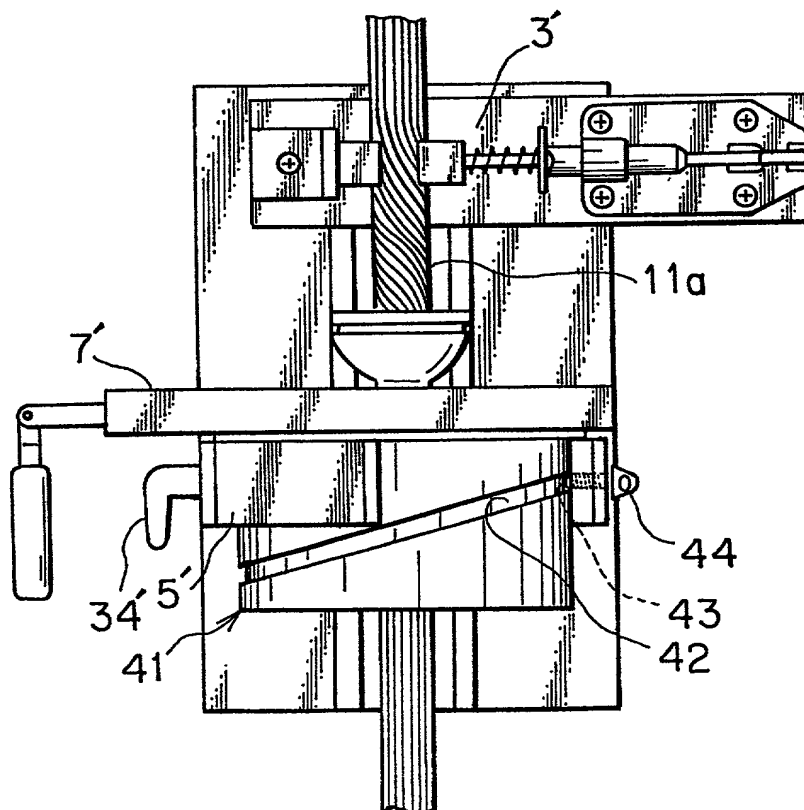




FIG. 9

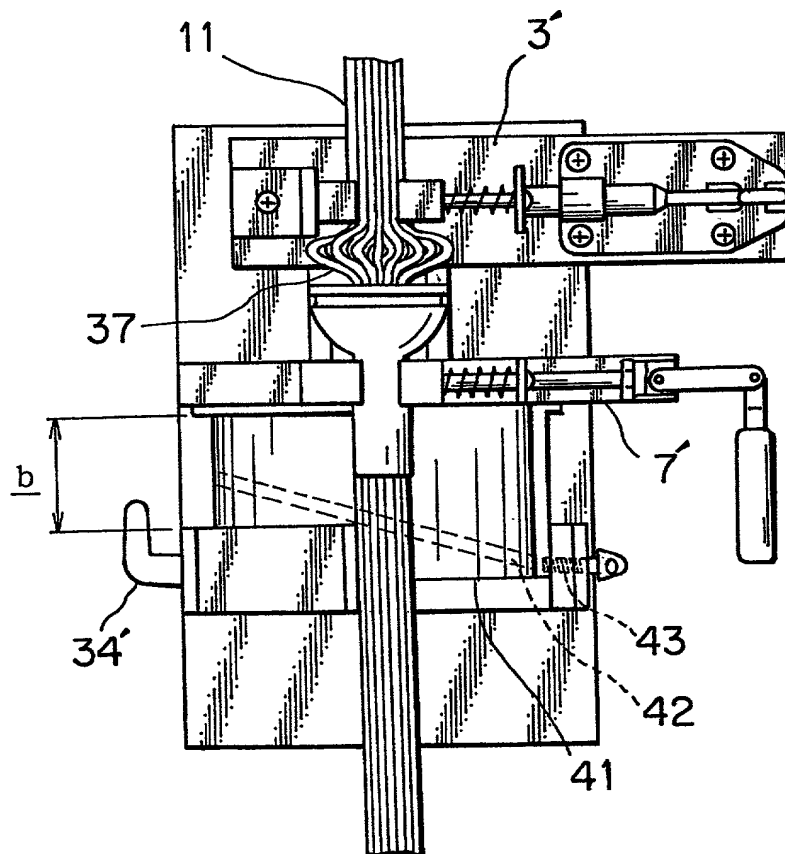


FIG. 10

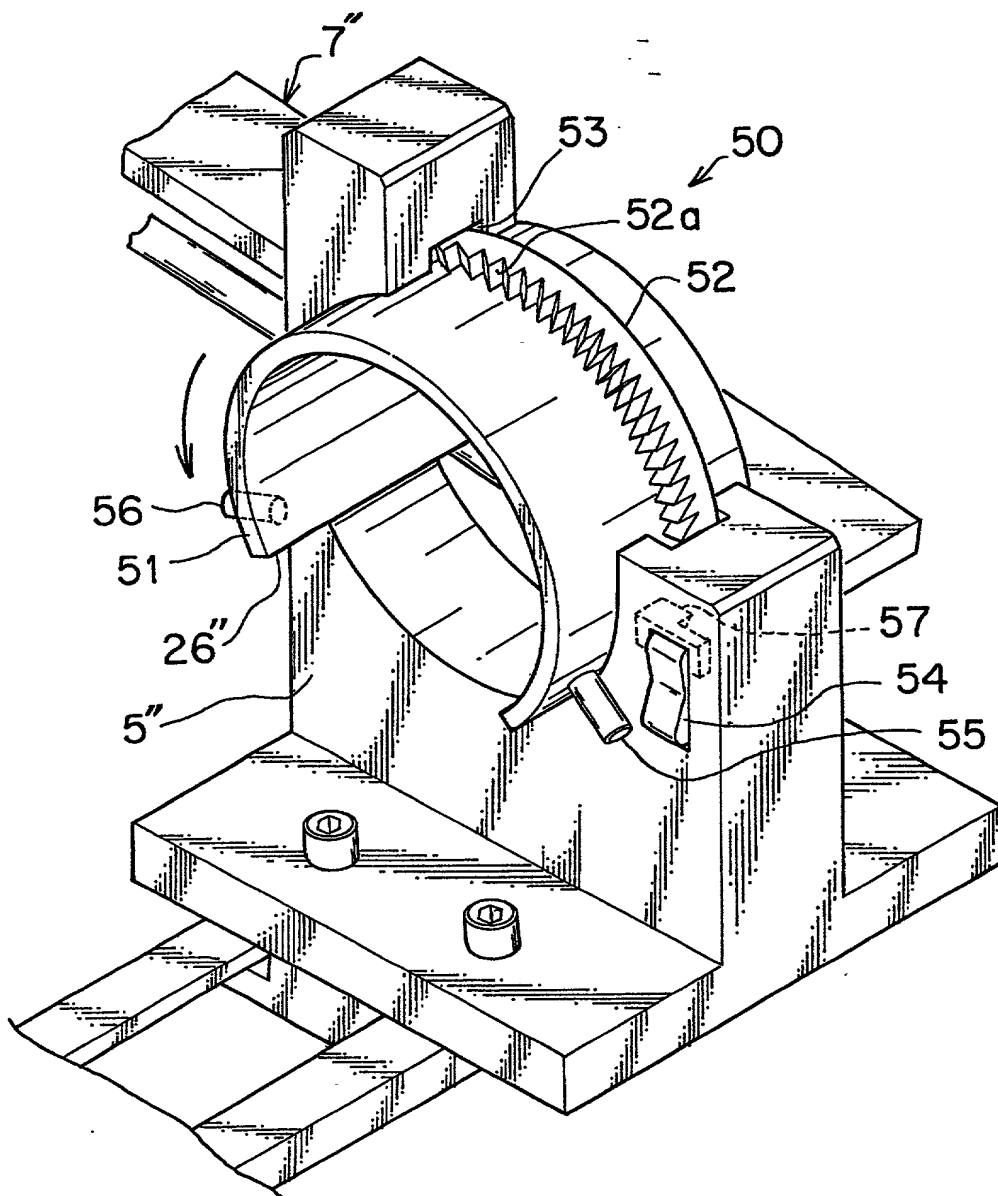


FIG. 11

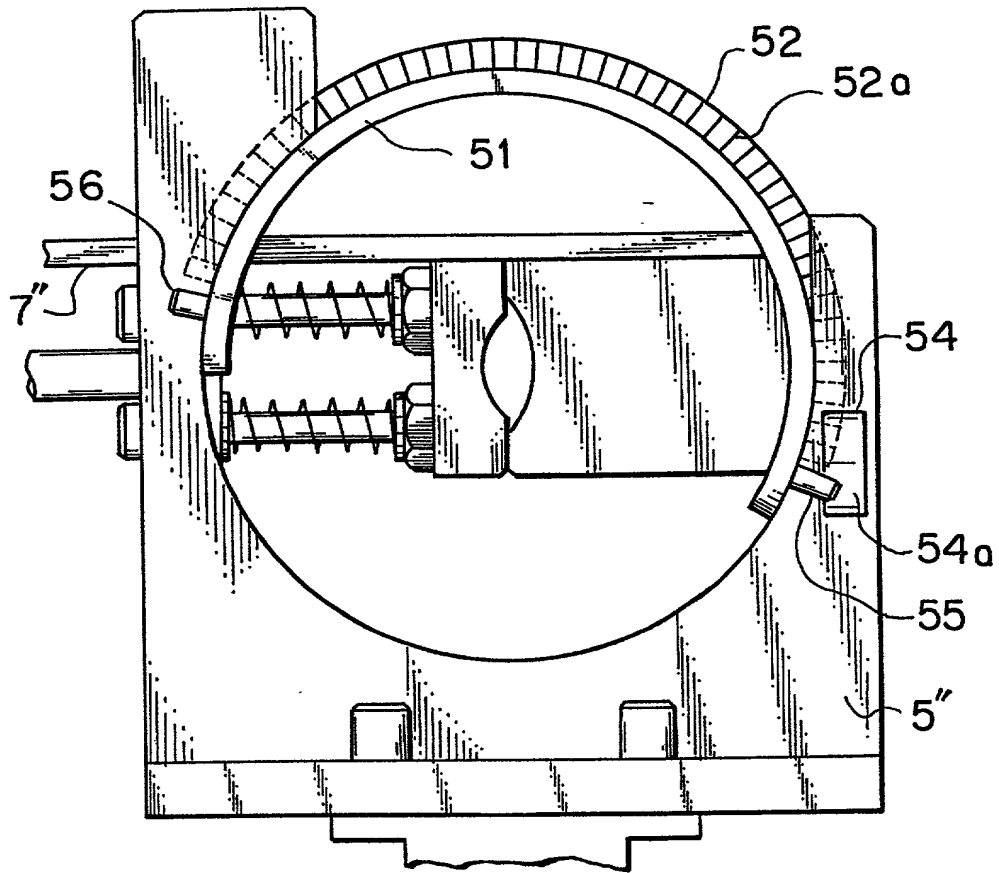


FIG. 12

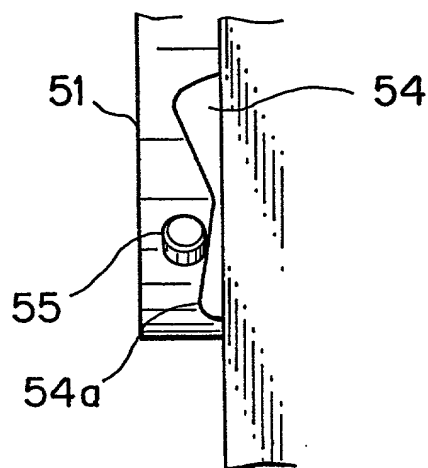


FIG. 13

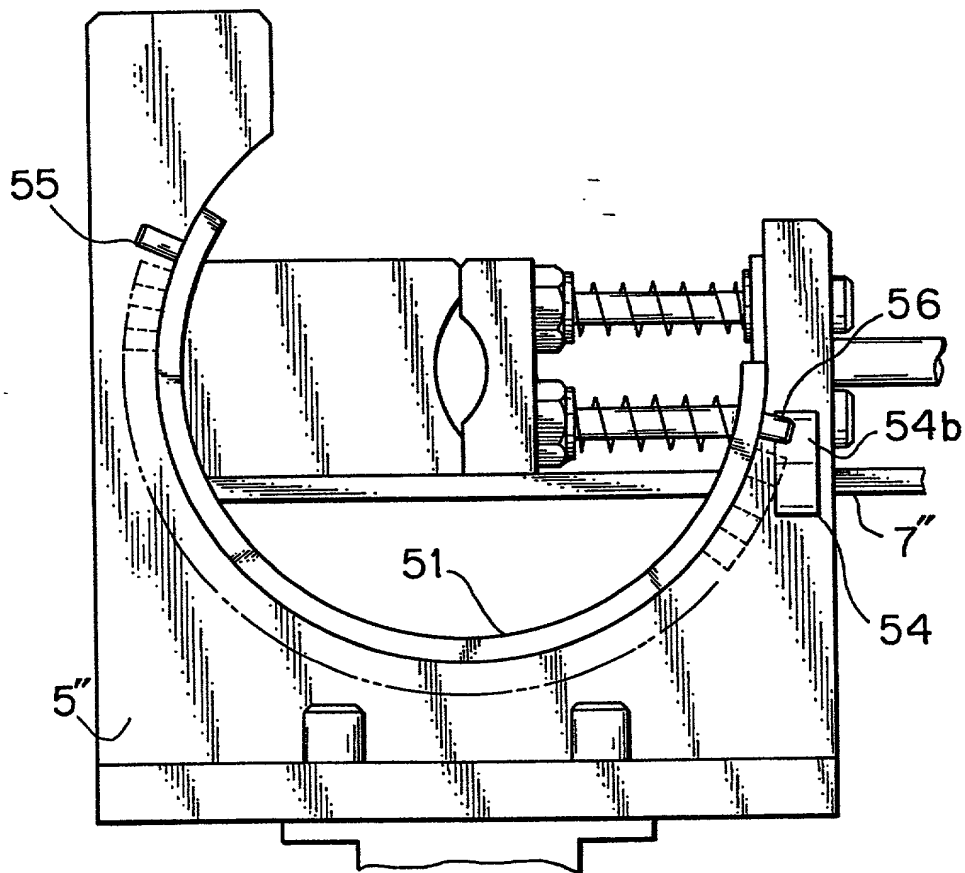


FIG. 14

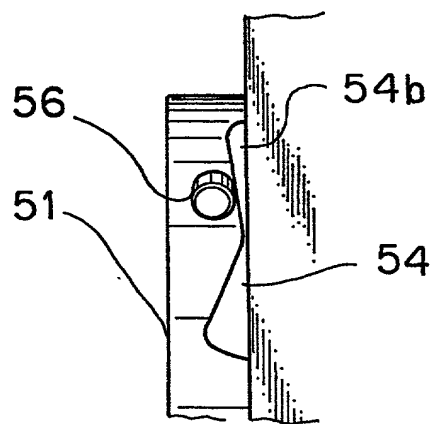


FIG. 15  
PRIOR ART

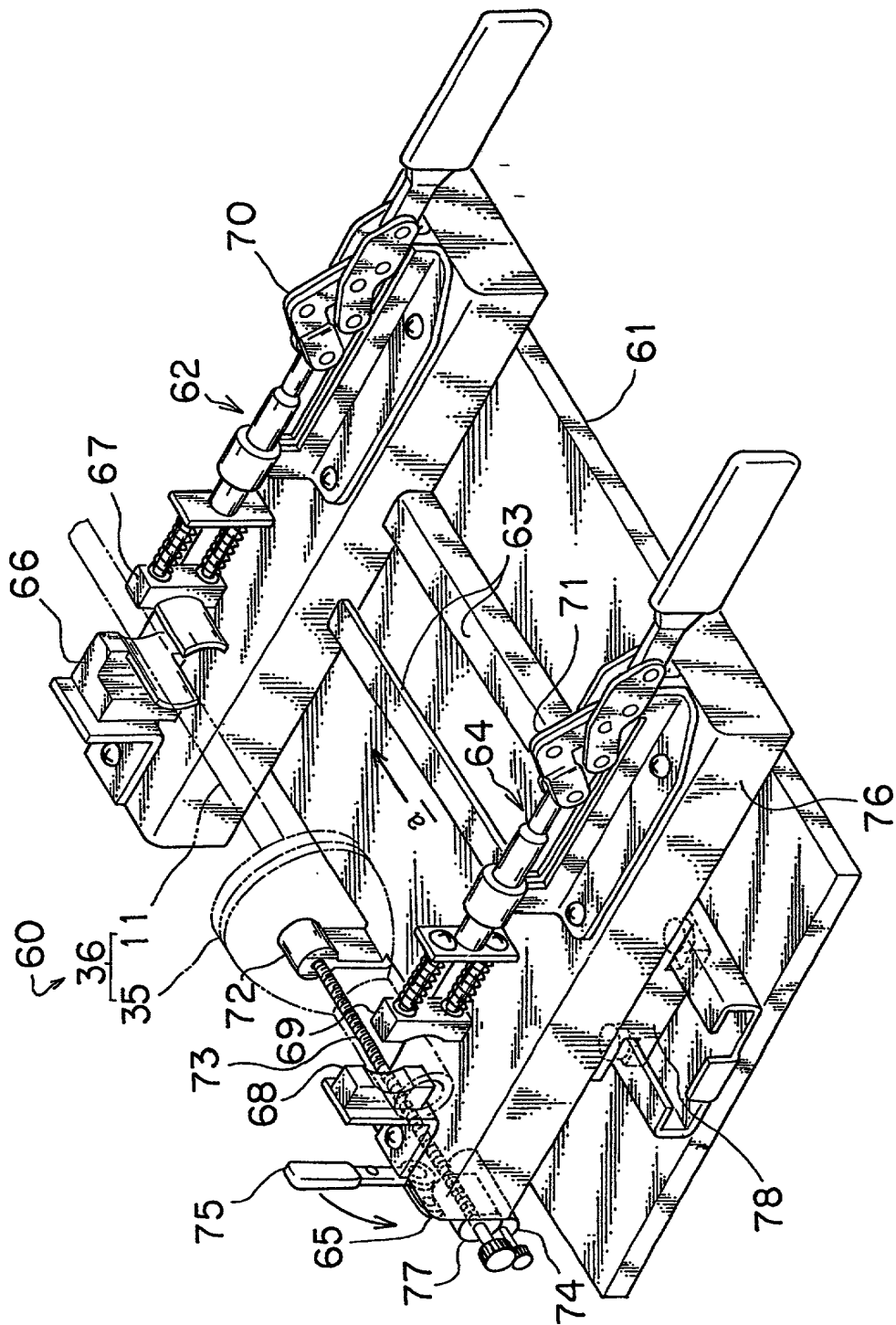


FIG. 16  
PRIOR ART

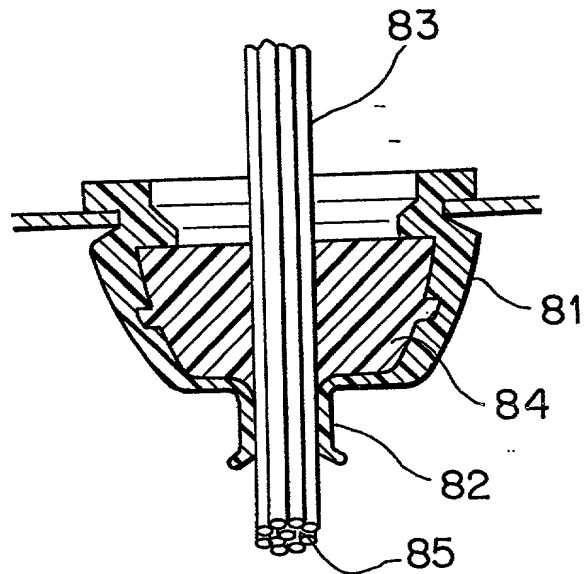
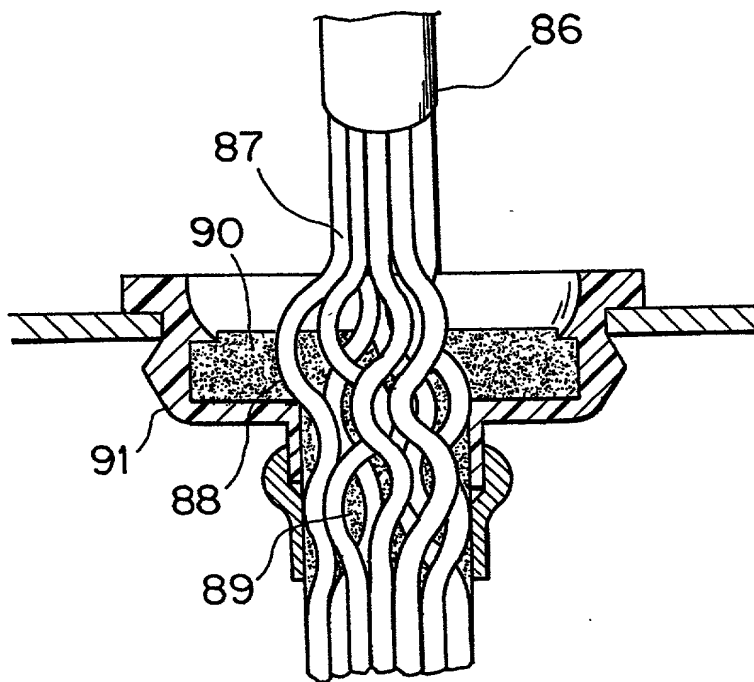
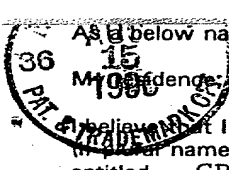


FIG. 17  
PRIOR ART





960474

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name

I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled GROMMET WATER-PROOFING METHOD AND WIRE-HARNESS LOOSING JIG

the specification of which is attached hereto unless the following box is checked:

☒ was filed on June 10, 1996 as United States Application Number or PCT International Application Number 08/661,085 and was amended on \_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code §119(a)-(d) of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

<u>7-144861</u>	<u>Japan</u>	<u>12/06/1995</u>
(Number)	(Country)	(Day/Month/Year Filed)
_____	_____	_____
(Number)	(Country)	(Day/Month/Year Filed)

Priority Claimed

<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
<input type="checkbox"/> Yes	<input type="checkbox"/> No



See attached list for additional prior foreign applications.

I hereby claim the benefit under Title 35, United States Code §119(e) of any United States provisional application(s) listed below.

_____	_____
(Application Number)	(Filing Date)
_____	_____
(Application Number)	(Filing Date)

I hereby claim the benefit under Title 35, United States Code §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code §112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

_____	_____	_____
(Application Number)	(Filing Date)	(Status -- patented, pending, abandoned)
_____	_____	_____
(Application Number)	(Filing Date)	(Status -- patented, pending, abandoned)

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

20

James E. Armstrong, III, Reg. No. 18,366; William F. Westerman, Reg. No. 29,988; Ken-Ichi Hattori, Reg. No. 32,861; John R. Pegan, Reg. No. 18,069; William G. Kratz, Jr., Reg. No. 22,631; Le-Nhung McLeland, Reg. No. 31,541; James P. Welch, Reg. No. 17,379; Ronald F. Naughton, Reg. No. 24,616; Albert Tockman, Reg. No. 19,722; Mel R. Quintos, Reg. No. 31,898; Michael J. Foycik, Jr., Reg. No. 30,928; Donald W. Hanson, Reg. No. 27,133; Stephen G. Adrian, Reg. No. 32,878; William L. Brooks, Reg. No. 34,129; Stephen B. Parker, Reg. No. 36,631; John F. Carney, Reg. No. 20,276; Edward F. Welsh, Reg. No. 22,455; Patrick D. Muir, Reg. No. 37,403; Gay A. Spahn, Reg. No. 34,978; and Theresa M. Stevens-Smith, Reg. No. 36,281.

Address all correspondence to: Armstrong, Westernman, Hattori, McLeland & Naughton  
1725 K Street, N.W., Suite 1000  
Washington, DC 20006

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor (given name, family name) Takahiro SAITO  
Inventor's Signature Takahiro Saito Date August 1, 1996  
Residence Shizuoka, Japan Citizenship Japan  
Post Office Address c/o Yazaki Parts Co., Ltd., 2464-48, Washizu, Kosai-shi,  
SHIZUOKA, 431-04, Japan

Full name of second inventor, if any (given name, family name) Norihiro YONEYAMA  
Inventor's Signature Norihiro Yoneyama Date August 1, 1996  
Residence Shizuoka, Japan Citizenship Japan  
Post Office Address c/o Yazaki Parts Co., Ltd., 2464-48, Washizu, Kosai-shi,  
SHIZUOKA, 431-04, Japan

Full name of third inventor, if any (given name, family name) Kenji USUI  
Inventor's Signature Kenji Usui Date August 1, 1996  
Residence Shizuoka, Japan Citizenship Japan  
Post Office Address c/o Yazaki Parts Co., Ltd., 1424, Washizu, Kosai-shi,  
SHIZUOKA, 431-04, Japan

Full name of fourth inventor, if any (given name, family name) Masaya UCHIDA  
Inventor's Signature Masaya Uchida Date August 1, 1996  
Residence Shizuoka, Japan Citizenship Japan  
Post Office Address c/o Yazaki Parts Co., Ltd., 1424, Washizu, Kosai-shi,  
SHIZUOKA, 431-04, Japan

Full name of fifth inventor, if any (given name, family name) \_\_\_\_\_  
Inventor's Signature \_\_\_\_\_ Date \_\_\_\_\_  
Residence \_\_\_\_\_ Citizenship \_\_\_\_\_  
Post Office Address \_\_\_\_\_

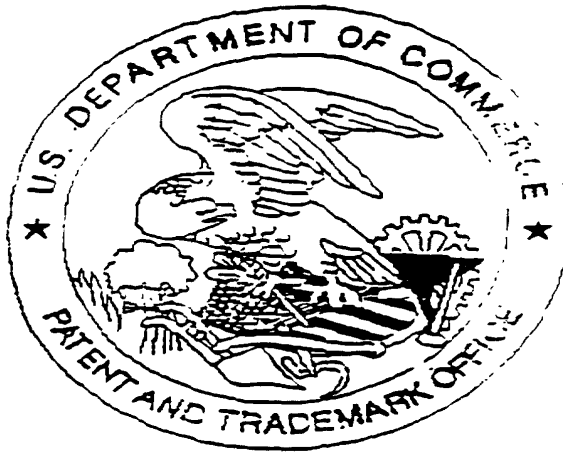
Full name of sixth inventor, if any (given name, family name) \_\_\_\_\_  
Inventor's Signature \_\_\_\_\_ Date \_\_\_\_\_  
Residence \_\_\_\_\_ Citizenship \_\_\_\_\_  
Post Office Address \_\_\_\_\_

Full name of seventh inventor, if any (given name, family name) \_\_\_\_\_  
Inventor's Signature \_\_\_\_\_ Date \_\_\_\_\_  
Residence \_\_\_\_\_ Citizenship \_\_\_\_\_  
Post Office Address \_\_\_\_\_

Full name of eighth inventor, if any (given name, family name) \_\_\_\_\_  
Inventor's Signature \_\_\_\_\_ Date \_\_\_\_\_  
Residence \_\_\_\_\_ Citizenship \_\_\_\_\_  
Post Office Address \_\_\_\_\_



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